INVESTIGATING RETURNS TO INVESTMENTS IN EDUCATION: AN EMPIRICAL STUDY ESTIMATING RETURNS TO PRIMARY, SECONDARY AND TERTIARY EDUCATION FOR COUNTRIES AT DIFFERENT LEVELS OF ECONOMIC DEVELOPMENT

A Dissertation

by

RICARDO VIVIANO LOZANO

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSPHY

May 2011

Major Subject: Educational Administration

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An Empirical Study Estimating Returns to Primary, Secondary and Tertiary Education

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ABSTRACT

Investigating Returns to Investments in Education: An Empirical Study Determining Returns to Primary, Secondary and Tertiary Education for Countries at Different Levels of Economic Development. (May 2011)

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Studies on returns to education disagree as to where these returns are highest. It is suggested that these disagreements are the result of inconsistencies in the data and methodologies used for their estimation. These disagreements specifically refer to where in education governments should invest in order to obtain the highest returns, based on the specific characteristics of their countries (i.e. level of economic development). The purpose of this dissertation is to estimate and determine whether returns to investments in education vary for groups of countries with different levels of economic development.

Rates of return to investments in education were estimated through improvements in methodology and data comparability. Subsequently, the differences among these returns and their significance were observed. This study provides evidence to suggest where in education countries should invest based on their specific level of economic development in order to obtain the highest returns to these investments.

TO GOD BE THE GLORY

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1. INTRODUCTION

1.1 THE RESEARCH PROBLEM

Research studies on returns to investments in education disagree as to where returns are highest. Consequently, policy recommendations often are in conflict over cost-effective allocation of resources. One particular area of disagreement is over what level of education (i.e. primary, secondary or tertiary) countries should invest their resources in order to maximize economic returns. For instance, Carnoy (1972, 1995a), and Carnoy and Marenbach (1975) state that returns to investments in education vary from country to country based on the level of economic development of the country under discussion. On the contrary, Psacharopoulos (1981), and Psacharopoulos and Patrinos (2004), claimed that the highest returns to investments in education are always observed at the primary level, regardless of the country's level of development.

It is clear that there are different, and conflicting, views regarding where in education governments should invest in order to obtain the highest returns. After closely observing and analyzing the different positions on returns to investments in education, it has been suggested that these discrepancies are the result of errors in measurement and data comparability among these studies (Amaghionyeodiwe & Osinubi, 2007; Harmon & Walker, 1999; Krueger & Lindahl, 2001).

This dissertation follows the style of *Economics of Education Review.*

The purpose of this dissertation is to determine whether there is a significant difference among returns to investments in education in countries at different levels of economic development. More specifically, this study:

- Estimates rates of return to investments in education through improvements in data collection and comparability.
- Applies a single methodology to the estimation of these returns.
- Compares returns to investments in education in countries at different levels of economic development and establishes whether their differences are statistically significant.
- Compares the newly estimated returns to education with the hypotheses proposed by Carnoy and Psacharopoulos concerning returns to investments in education in countries at different levels of economic development.

1.2 BACKGROUND

Numerous studies have been conducted with the purpose of suggesting factors contributing to economic growth and development. These studies have arrived to a series of different conclusions. However, it is clear that no single factor is fully responsible for overall national development and economic growth (Perkins, Radelet, Snodgrass, Gillis, & Roemer, 2001; Ray, 1998). Development is an extremely complex, multidimensional issue; difficult to define and measure. Yet, among the many factors promoting economic

growth and development, human capital, in the form of formal education, has been recognized as a consistent, major contributor (Besley & Burgess, 2003; Easterly, 2007).

Public expenditure in formal education is suggested to be money well spent. Investments in human capital, in the form of formal schooling, have a positive effect on economic growth at both, the national and individual levels (Duflo, 2001; OECD, 2004; Sherman, 1994). There is no question that investing in human capital in the form of formal education is beneficial; the pressing question is *where* in education investments should be made. This is an extremely important issue, particularly when policies on investments in the different levels of education are developed and implemented (Besley & Burgess, 2003; McMahon, 2002). This dissertation attempts to suggest the efficient allocation of resources to primary, secondary and tertiary education considering the specific characteristics of individual countries (i.e. level of economic development).

1.3 DEFINITION OF KEY TERMS

1.3.1 Economic Growth

Economic growth refers to a rise in national or per capita income and product (Perkins, et al., 2001).

1.3.2 Economic Development

Economic Development, in addition to a rise in per capita income, implies fundamental changes in the structure of the economy. Two of the most important of these structural changes are the rising share of industry, along with the falling share of

agriculture in national product, and the increasing percentage of people who live in cities rather than the countryside. In addition, countries that enter into economic development usually pass through periods of accelerating, then decelerating, population growth during which the country's age structure changes dramatically. Consumption patterns also change as people no longer have to spend all their income on necessities but instead move on to consumer durables and eventually to leisure-time products and services. A key element in economic development is that the people of the country must be major participants in the process that brought about these changes in structure. Additionally, if growth benefits only a tiny, wealthy minority, whether domestic or foreign, it is not development. And lastly, the application of science to problems of economic production, leading to industrialization and urbanization is also an important determinant of development (Perkins, et al., 2001).

1.3.3 Gross National Income (GNI)

GNI is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad (World Bank).

1.3.4 Wages

Wage or salary is the rate paid for normal time of work, comprising: basic wages and salaries, cost-of-living allowances and other guaranteed and regularly paid allowances. The following should be excluded: overtime payments, bonuses and

gratuities, family allowances, other social security payments made by the employer directly to employees and ex gratia payments in kind supplementary to normal wage and salary rates (ILO Bureau of Statistics).

1.3.5 Social Returns to Education

Social returns to education refer to the large scale benefits from investments in education. Social returns to education take into consideration the direct costs of schooling incurred by governments or institutions.

1.3.6 Private Returns to Education

Private returns to education refer to the individual's benefits from investments in education. Given the fact that social returns to education take into consideration the direct costs of education incurred by governments or institutions, private returns to education are usually greater than social returns.

1.4 LIMITATIONS

- Since the data used on this study is sorted by level of education (primary, secondary and tertiary), and not number of years in school, the conclusions of this study are limited to level of education. This is, the findings are applicable to social and private rate of returns to investments by *educational level*; not by additional *year(s) of schooling*.

- When estimating social returns to investments in education, the notion that the post-versus pre-tax treatment of earnings does not make a big difference in a rate of return calculation (Psacharopoulos, 1981) is considered. This is to establish that when estimating social and private rates of return to education, the same average income levels per level of education provided by the International Labor Organization for both rates of return are considered. The difference between social and private returns to investments in education is thus the result by considering the cost of schooling in the estimation of social returns to education.

- When dealing with education and economic development, cause-effect does not only run from investment in education to economic growth. Growth might also cause an increased investment in education, particularly when investments in education are based on percentages of GNI (Bils & Klenow, 2000). Through this dissertation, this issue is approached by observing the existing differences between returns to primary, secondary and tertiary education in countries at different levels of economic development. In other words, the purpose of this dissertation is not to approach the issue of causality; rather, it is to observe whether countries at different levels of economic development have different returns to investments in primary, secondary and tertiary education. Consequently, the results of this analysis provide data regarding where in education economic returns are the highest. This might be used as the basis for

policy recommendations regarding investments in education for countries at different levels of economic development.

1.5 METHODOLOGY

There are several methodologies used in the estimation of returns to education. Among the most frequently used are ordinary least squares (OLS), quantile regression (QR), Heckman's two-stage selection model, double-hurdle model (DHM), instrumental variables (IV), the elaborate method, and the earnings function and short-cut methods based on the Mincerian equation.

When applying different methodologies to the estimation of returns to education, the conclusions tend to be the same; the difference in results lays on the specificity and comparability of the data utilized in the estimation of these indicators. Additionally, data availability often marks the difference between methodologies applied to the estimation of returns to education.

Menon (1997, 2008) estimated rates of return to higher education in Cyprus, using the elaborate and short-cut methods. The data requirements of the elaborate method are certainly more demanding than those necessary to estimate returns to education through Mincer's short-cut method. Menon concluded that the returns estimated through both methods were similar enough to suggest that the short-cut method may be used as a substitute for the elaborate method when data for the estimation of returns through the elaborate method are not available. Based on Menon's observations, it is safe to assume that the use of the short-cut method for estimation of

returns to education is as valid as the elaborate method, particularly when presented with the challenge of data availability. This is particularly true when comparing international data from low-income economies, where data on wage differentials resulting from years of experience are not readily available.

Initially, this study also tested the viability of the short-cut method for estimating returns to education by comparing its results with the results of estimating returns to education through the earnings function method; a method also based on the Mincerian equation but more data demanding than the short-cut method. Returns were initially estimated for 28 countries with sufficient data available (i.e. higher income economies). This was accomplished with the purpose of suggesting that the results yielded by both, the earnings function and short-cut method, are truly similar.

Once the notion that the short-cut method may be used as a substitute for the earnings function method was established, the challenge of methodology was addressed by applying a single methodology, the short-cut method, to the estimation of rates of return to investments in education for 59 countries at different levels of economic development. The challenge of methodology refers to the wrongful assumptions made when comparing returns to education estimated through different methodologies. By applying a single method to the estimation of rates of return to investments in education at the international level, the data generated is made consistent, and thus, comparable.

The challenge of inconsistencies in data sources faced by international estimates to investments in education was addressed by estimating returns with data collected by a single source, the International Labor Organization. Ideally, data derived from national

surveys would seem to be the optimal way to assure data comparability. However, since each country uses its own national surveys, and thus, its own definitions and measurements, the condition of perfect comparability is difficult to meet. Consequently, in a cross-country project it is preferable that data is reasonably comparable across countries (Harmon, Oosterbeek, & Walker, 2003). Data from ILO provides the closest approximation to this notion. This is particularly true, since one of ILO's major tasks is to provide standards and guidelines to help countries improve the reliability and comparability of their statistics.

1.6 ANALYTICAL TECHNIQUES

Stata statistical software was applied to the estimation and analysis of returns to education through both, the earnings function and short-cut methods. Initially, the data were analyzed through the application of summary statistics with the purpose of establishing its validity and usability. Frequencies, means and standard deviations were used to provide general descriptions of individual variables, as well as for the reasonable removal of outliers.

In order to estimate returns to investments in education via the earnings function method, multiple regression analyses were conducted. Also, when estimating the relationship between returns to education estimated through the earnings function and short-cut methods, linear regression and correlation analyses were applied.

Analyses of variance and multiple comparisons procedures were conducted in the description of general differences between returns to primary, secondary and tertiary

education. Additionally, analyses of variance and multiple comparisons were also conducted for the description of general differences between returns to investments in education for countries at different levels of economic development.

1.7 SAMPLING

Given the nature of this study, the sampling technique utilized was convenience sampling. The process followed in defining the sampling size began by finding the country classification provided by World Bank. This was necessary in order to delineate groups of countries at different levels of economic development. Secondly, the list of countries provided by World Bank was compared with the country reports provided by LABORSTA, the international database on labor statistics operated by the International Labor Organization Department of Statistics. These reports provide national data on mean income levels for individuals classified by employment type. It is important to establish that LABORSTA does not supply data on each of the countries listed by the World Bank. Of the 209 countries listed by the World Bank in its income-level classification, LABORSTA provides reports for 91 of them. Thirdly, the 91 country reports provided by LABORSTA were sorted to identify countries with data available between 1997 and 2007. Fourthly, the availability of comparable (i.e. same years) data on Gross National Product, as well as expenditure per pupil at different educational levels through the World Bank's World Development Indicators was established. The sample size is the number of countries with 100% comparable data utilized in the estimation of rates of return to investments in education. In this particular case, and

based on the available data, private returns to investments in education were estimated for 59 countries and social returns were estimated for 47 countries.

1.8 SUMMARY

The purpose of this dissertation is to contribute to the existing literature on rates of return to investments in education at the international level. Currently, the existence of controversies regarding where in education investments should be made in order to obtain the highest returns, has polarized the literature on returns to education. Two major schools of thought have emerged claiming that returns are highest at the primary level regardless of the country's level of economic development (Psacharopoulos, 1981; Psacharopoulos & Patrinos, 2004); and that returns vary according to the level of economic development of specific countries (Carnoy, 1972, 1995b; Carnoy & Marenbach, 1975). It has been suggested that these controversies are the result of returns being estimated through different methodologies and data collection techniques, thus making the results dissimilar, and consequently, difficult to compare (Amaghionyeodiwe & Osinubi, 2007; Harmon & Walker, 1999; Krueger & Lindahl, 2001).

Through this study, returns to education have been estimated addressing the challenges of methodology and data comparability. These challenges have been contended with, through the application of one single methodology (the short-cut method for estimating returns to education derived from the Mincerian equation) to the estimation of the returns, and through the collection of data from a single source: the International Labor Organization (ILO). The results have been, in turn, compared in

order to determine whether returns to education are different among countries at different levels of economic development. The results have also been compared with the major schools of thought regarding returns to investments in education in order to contribute to the existing literature on returns to education.

Section 2 provides a review of the available literature in regards to economic growth and development, human capital development through investments in formal education, the controversies concerning allocation of resources to education, and returns to education including the challenges set by their estimation. Section 3 contains the methodologies utilized in this study for the estimation of returns to education, an analysis of the data used in the study, and a preliminary study suggesting the short-cut method for estimating returns to education based on the Mincerian equation to be a viable method in the estimation of these returns. Section 4 presents the analysis of the data. Section 5 contains conclusions and implications for theory, research and policy.

2. LITERATURE REVIEW

2.1 INTRODUCTION

In this section, detailed definitions of economic growth and development are provided, and an abbreviated version of the historical evolution of growth theories is presented. Then, the major factors contributing to economic growth and development are reviewed. After suggesting that human capital is a major variable in the promotion of economic growth and development, literature substantiating the notion of human capital as a pre-condition for growth is presented. A general view on human capital theory followed by literature proposing formal education as a promoter of human capital development is presented. Next, the major controversial views regarding the optimal allocation of resources in education are discussed, and rates of return to education defined, followed by a brief presentation of the most frequently used techniques to estimate these returns. Subsequently, literature substantiating the substitutability of the two methodologies derived from the Mincerian equation; the earnings function and the short-cut methods, is presented. Lastly, endogenous and exogenous variables impacting the estimating of returns to investments in education are introduced.

2.2 ECONOMIC GROWTH AND DEVELOPMENT DEFINED

2.2.1 Economic Growth

Economic growth is a concrete term, relatively simple to define. It essentially "refers to a rise in national or per capita income and product" (Perkins, et al., 2001, p. 8).

Perkins' definition of growth is a rather condensed and compact one. It simply defines growth as the result of the increase on income alone.

Historically, one of the earliest succinct definitions of economic growth is Denison's, who is 1962 defined it as "the increase in the national product, measured in constant dollars" (p. 3). Denison's definition can be explained by stating that in order to observe economic growth, we simply need to observe a country's national product for two given years, measure it in constant dollars, and calculate the difference. Later, in 1990, Cohn and Geske incorporated the notion of time into their definition of economic growth, and defined it "as the rate at which per capita national product in constant dollars grows over a given period of time" (p. 135). As observed through these definitions, economic growth may be viewed as the change in national or per capita income, measured by its changes through time.

Economic growth, although defined in simple terms, is a rather complex issue. According to Cohn & Geske (1990), some of the challenges faced by a simplistic definition of economic growth based on national income, are that it measures only the products and services provided in the marketplace, leaving important factors such as food processing and the use of servants in households out of the equation. Additionally, in recent years, the use of more sophisticated reporting tools has contributed to a potential overestimation of the economic growth of an economy, since it provides for a more extensive reporting of the extent of production. Furthermore, price increases in consumer goods may be the result of different factors such as inflation or increased quality; which is difficult to determine in an objective manner. This could also have a

negative effect in the objective measurement of economic growth. Despite all of its shortcomings and, due to the lack of a better measure, national income is the most objective measure to define economic growth (Cohn & Geske, 1990).

2.2.2 Economic Development

Development, unlike growth, cannot be easily defined. Although there is an intuitive understanding of what development is, there is also great controversy regarding how to define it in concise, objective terms. When attempting to define economic development, Perkins et al. (2001) make a clear presentation of different aspects related to this, difficult to define, term, and states that development, in contrast with growth, implies "fundamental changes in the structure of the economy" (p. 9). These fundamental changes in the structure of the economy involve a rising share of industry and falling share of agriculture in national product, as well as an increased percentage of the total population living in cities rather than the countryside. These changes in the structure of the economy also include changes in consumption patterns marked by an increased consumption of leisure-time products and services. But the key element in economic development "is that the people of the country must be major participants in the process that brought about these changes in structure" (p. 9). If growth benefits only a wealthy minority, it cannot be considered as development. Lastly, "[t]he application of science to problems of economic production, leading to industrialization and urbanization is also an important determinant of development" (p. 9).

Based on this notion, it is clear that development is a concept that extends beyond income, including variables such as nutrition, life expectancy, access to sanitation, health services, literacy, and empowerment. However, the multidimensionality of this concept makes it necessary to reduce it to concise terms in order for it to be observed and measured objectively. Due to the complexity of this subject, there is a widespread understanding that the percentage of the active population engaged in agricultural occupations, as well as Gross National Income (GNI) are imperfect, yet acceptable ways for policymakers to observe and approach issues concerning national development (Harbison & Myers, 1964). When referring to defining development as a function of GNI, Ray (1998) explains this complex issue by stating that "the view that economic development is ultimately fueled by per capita income may be taking things too far, but at least it has the virtue of attempting to reduce a larger set of issues to a smaller set, through the use of economic theory"(p. 9). In other words, in order to simplify a rather complex notion, it is necessary to reduce it to a smaller concept; easier to measure and analyze in more objective terms so that theory can be drawn from it.

Attempts to define and measure economic growth and development have led to the formation of growth theories. These theories have evolved through time, gradually increasing the number of factors to be taken into consideration when measuring economic growth.

2.3 GROWTH THEORIES

Numerous efforts have been made to determine ways to measure and define the rate of growth of an economy. These efforts have been the driving force in the establishment of a series of growth theories. This section presents a brief historical representation and examples of the three major economic growth theories: basic, neoclassical, and new. These theories are based (as most models of economic growth are) on aggregate production functions that measure the value of output or national product, given the value of the aggregate stock of specific inputs (Lim, 1996). The purpose of this section is to illustrate the evolution of growth theories from accounting for capital and labor supply as the only variables having an effect on economic growth, to more sophisticated theories incorporating variables such as technology and human capital as variables influencing growth.

2.3.1 Basic Growth Model (Harrod-Domar)

The Harrod-Domar basic economic growth model is named after English economist Roy Harrod (1900-1978) and Polish-born American economist Evsey Domar (1914-1997). Since its inception during the 1940s, this theory has been used extensively by developing countries to examine the relationship between growth and capital requirements. In this model, the production function has a very precise form, in which output is assumed to be a linear function of capital. The basic growth model postulates that output (i.e., economic growth) (Y) is a function of the capital stock (K) and labor supply (L).

$$Y = F(K, L) \tag{2.1}$$

Through the Harrod-Domar basic growth model, policymakers can set a target for the rate of economic growth they wish to achieve; in which case the equation will tell them the level of saving and investment necessary to achieve the target growth rate (Perkins, et al., 2001).

Some of the major limitations of the model are that the capital stock and the labor force must always grow at the same rate to maintain equilibrium (with full employment of both the labor force and the capital stock); which is very unlikely to happen. Also, the Harrod-Domar model does not take different allocation of resources in different sectors into consideration. In other words, it is possible that countries with lower investments in capital, but with a more efficient allocation of resources, may end up growing faster than countries with higher levels of investments in capital (Lim, 1996). Additionally, the quality of the labor supply is not taken into consideration in the model. Finally, the basic growth model is inaccurate in long periods of time (Perkins, et al., 2001).

The message of the Harrod-Domar model is simple: save more and make productive investments. Saving may take place through private domestic savings (i.e., household and corporate savings), as well as through government budgetary savings. Finally, according to the basic model, investments in capital and labor are necessary for economic growth. However, the model does not consider the specific, efficient allocation of resources (Lim, 1996; Perkins, et al., 2001).

2.3.2 Neoclassical Growth Model

Ramsey (1928), Solow (1956), Swan (1956), Cass (1965), and Koopmans (1965) introduced a new model of economic growth that represented an important step forward from the basic growth model. The neoclassical growth model's addition to the basic model is based on the law of diminishing returns to individual factors of production (Ray, 1998). The model assumes diminishing returns to capital and perfect employment. Derived from the diminishing returns to capital, the neoclassical model introduces the notion of convergence: the lower the starting level of real per capita gross domestic product, the higher the predicted growth rate (R. Barro, 1997). The idea of convergence suggests less developed countries to have a higher growth rate that would eventually result on their becoming equal with developed nations. However, the most important contribution of the neoclassical model is the relationship between technological change and growth.

In the neoclassical model's production function, output (Y) is a function of capital (K), labor (L), and technological progress (T).

$$Y = F(K, L \times T) \tag{2.2}$$

In the neoclassical growth model, technology is introduced in such a way that it directly enhances the input of labor, also known as labor augmenting. Thus, increases in technology can result in improvements in technology in the mechanical sense (e.g., new computers or machines) or in terms of human capital, such as improvements in the

health, education, or skills of the workforce. Also, in the neoclassical model, technical progress refers to all the things which increase the productivity of the factors of production and lead to a rise in total productivity. It thus means more than improvements in the technology of producing goods and services, but also to improvements in the design, sophistication and performance in plant and equipment, which lead to higher productivity (Lim, 1996).

The major limitations of the neoclassical model are that it does not account for the quality of human capital. In other words, the neoclassical model does not consider the initial knowledge, experience or educational level of individuals. Also, this model does not consider sustainable growth or how to make it happen (Perkins, et al., 2001).

The neoclassical model introduced the idea that technological change has a direct impact on growth. In other words, the model suggests that growth can be attained when an economy has the capacity to increase output with unchanging inputs of capital and labor; possible through technological change alone (Perkins, et al., 2001). This model suggests two ways of increasing productivity. The most important being the use of more efficient technology (i.e., more output with the same volume of inputs, or the same output with fewer inputs), and increasing the level of capital utilization (Lim, 1996).

2.3.3 New Growth Theories

Romer (1986), Lucas (1988), and Rebelo (1991) are the major proponents of the new growth theories. Their main contribution to growth theory is the integration of

human capital (HK) to capital (K) and labor (L) as the major variables affecting economic growth.

$$Y = F(K, L, HK) \tag{2.3}$$

Human capital is "the value markets place of the work done by individuals who have invested in varying amounts of schooling, formal on-the-job training, and informal training (Carnoy, 1995b). It is important to emphasize that investments in human capital development, as viewed in the light of the new growth theories are deliberate, and not only the outcome of population growth or the result of technical progress (Ray, 1998). According to the new growth theories model, investment in human capital has two distinct effects: internal and external. The internal effect of investing in human capital is the increased income of the individual, whereas the external effect is the betterment of society as a whole. With the idea of internal and external effects of investments in human capital, this model introduces the idea of externalities. Externalities might be defined as the positive and negative effects of an economic agent's activities which are not taken into account by the market system. In other words, the concept of externalities refers to the idea that certain investments have an unplanned effect on other parts of society or the economy. For example, investments in education, apart from the benefits directly related to the individual acquiring it, might have a positive spillover effect on society as a whole, such as an overall reduction in violence and crime (Lucas, 1988; Ray, 1998).

The greatest advantage of the new growth model, is that growth may go on indefinitely because the returns to investment in human capital do not necessarily diminish as economies develop (R. Barro, 1997). This is to say that, investments in human capital development will invariably have a positive, direct or indirect effect on economic growth.

The growth theories presented in this section, basic, neoclassical and new, have developed as efforts to measure the growth rate of an economy. These theories have evolved through time, each contributing to the complex set of factors suggested to have an effect on economic growth and development.

2.4 MAJOR FACTORS CONTRIBUTING TO ECONOMIC GROWTH AND DEVELOPMENT

Historically, growth theories have proposed the main variables influencing economic growth and development. Scholars have explored this complex issue, and have arrived at different conclusions concerning the major variables affecting growth and development. In practical, specific terms, the most commonly noted promoters of economic growth and development are: investment in human capital, increasing savings and exports, import substitution, labor-intensive techniques, income redistribution, provision of basic needs to the poor, allowing markets to define prices and the allocation of resources, and more recently, the replacement of free market by central planning (R. Barro, 1997; Lim, 1996; Perkins, et al., 2001; Ray, 1998).

Ray (1998) proposed that no single factor is fully responsible for national development and economic growth. Perkins (2001), in agreement with Ray, states that, apart from no single factor being responsible for growth and development, "no single policy or strategy can set in motion the complex process of economic development" (p. 24). In other words, apart from development not being the result of single factors acting independently, no one specific policy or strategy is sufficient to promote growth and development. There are factors and policies that, when implemented in the right context, would result in actual development. Therefore, the understanding of the particular context is vital for the development and implementation of policies geared towards national growth and development. "[A] wide variety of explanations and solutions to the development problem makes sense if placed in the proper context and makes no sense at all outside that set of circumstances" (p. 24).

Despite the fact that no single factor or policy alone would be sufficient to promote development, through detailed observation and study, some have concluded that there is a small number of variables that, when combined in the right proportion, might further growth and development. Besley and Burgess (2003) viewed the accumulation of human capital, physical capital, and technological change as the main elements promoting growth and development. Also, when observing the main components of growth and development, Easterly (2007) concluded that the three main promoters of growth and development are redistributive policies, quality of institutions, and human capital. Both, Besley and Burgess (2003), and Easterly (2007) concurred that human capital is a determinant factor of growth and economic development.

2.5 HUMAN CAPITAL DEVELOPMENT: A PRE-CONDITION FOR GROWTH

After conducting a longitudinal study observing three decades of history in high-performing Asian economies, Mingat (1998) stated that even though economic growth has not always promoted more egalitarian societies, high-performing Asian economies have implemented, explicitly or implicitly, a variety of national policies that have fostered this positive outcome. "General macroeconomic policies (savings and investment policies, export oriented regulations, etc.) have obviously played a role" (p. 696) in this economic growth. However, these countries, instead of putting general democratic principles into action, have, in a sense, "adopted a more pragmatic approach by getting the population to adhere to global policies"(p. 696) to assure that all members of society will benefit from economic growth. Mingat later explains that one of the factors most likely to explain the economic growth in East Asia since the 1960s has been the investment in human resource development.

When compared with countries with similar per-capita income more than three decades ago, most high-performing Asian economies had a higher level of investment in education than their counterparts. For example, according to Mingat, around 1950-1960, Pakistan, China, India and Indonesia had relatively modest coverage in primary schooling, while Japan, Korea, the Philippines and Taiwan, already had almost universal coverage for primary schooling. It seems that, according to Mingat's observations, investment in education is a pre-condition for economic growth. Lim (1996) arrived to the same conclusion and observed that "the rapid growth of the Japanese and Korean

economies probably owed much to the mass literacy and numeracy achieved early in the process" (p. 149)

Rodrik (1995) after studying Korea's and Taiwan's economic growth since the early 1960s concluded that, even though it is believed that these countries heavy emphasis on export orientation played a significant causal role in their growth, the already existing extremely well educated labor force relative to their physical capital stock is a more likely cause for their astounding economic growth. When comparing these countries with similar economies in per capita income levels, Rodrik found that both, Korea and Taiwan "had virtually universal primary school enrolment, while the norm for countries at their income levels stood at around 60% only. Korea had more than double the literacy rate compared to the norm, and Taiwan's literacy rate was one-and-a-half times as high. It is clear that both countries had a labor force that was considerably better educated than would be predicted from their income levels" (p. 76).

If the development of human capital, as suggested by the new economic growth theories, is viewed from the perspective of an industry, industrial policy (defined by Pack and Saggi (2006) as any type of selective intervention of government policy that attempts to alter the sectoral structure of production toward sectors that are expected to offer better prospects for economic growth) could be geared towards the development of human capital with the purpose of promoting economic growth. Consistent with Rodrik and Mingat, Pack and Saggi also observe that in India, "the preconditions for development of the software sector were high quality education" (p. 35). When observing the preexisting conditions for economic growth and development, it seems

clear that a more highly educated population will be most likely to take advantage of economic growth opportunities when they appear. Rodrik, Mingat, Lim and Pack and Saggi agree upon the fact that education is a pre-existing condition for economic growth and suggest that industrial policies be implemented with education as a promoter of growth in mind.

2.6 HUMAN CAPITAL

Through the previous section, it has been established that human capital development is essential, and a pre-existing condition, to economic growth. The following section focuses on human capital theory, its history, and its main contributors.

At this point, it would be convenient to reiterate the fact that human capital may be defined as "the value that markets place on the work done by individuals who have invested in varying amounts of formal schooling, formal on-the-job training, and informal training" (Carnoy, 1995b, p. 9). The concept of human capital is certainly not a recent development. Originators of this idea, such as Adam Smith (1776) and Heinrich Von Thünen (1826) suggested that an individual's talents obtained through education or experience contribute to not only the individual's wealth, but also to the wealth of the society to which they belong. The pioneers of human capital theory also suggested that human talent and capacity may be compared to machinery or any other type of capital that facilitates labor and repays its expense with profits (Cohn & Geske, 1990).

Building upon the foundation laid by Smith and Thünen, Becker (1964) and Schultz (1971) contributed to the development of human capital theory. Becker (1964)

observed that the growth of physical capital alone "explains a relatively small part of the growth and income in most countries" (p. 1) and suggested the existence of "a tremendous amount of circumstantial evidence testifying to the economic importance of human capital, especially of education". According to Becker, the most impressive difference made by human capital is seen in the earnings differential between the educated and the uneducated.

Schultz (1971) explained that his observations of the contributions of the sciences to production arouse in him a curiosity, as he observed that advances in the sciences *per se* could not explain total gains in productivity. He then viewed the role of the acquired abilities of human agents as a major source of these gains in total productivity. Later, he concluded that "the traditional concept of capital had to be extended to make room for human capital" (p. v). As a result of these observations and his own studies, Schultz saw the inadequacies of the traditional concept of capital of his times and suggested the heterogeneity of capital; human capital being one of its many components. When observing that income levels increased with increased investments in education by individuals, regardless of their race and gender, Schultz was able to suggest that education is the major contributor to wage differentials among individuals. Also, Schultz concluded that when education is observed and treated as an industry, producing a specific output, it is easier to observe the results of investing in this particular industry.

In recent years, literature has increased exponentially in support of human capital development and its unquestionable positive effect on economic growth. Human capital theory perfectly filled the previously existing void in growth theory, explaining how

human capital must be treated as one of the components of the multifaceted, heterogeneous definition of capital. This idea parallels the new growth theories of economic growth. Additionally, human capital theory is consistent with the suggestions of Rodrik (1995), Mingat (1998), Lim (1996) and Pack and Saggi (2006) proposing that industrial policies on education be implemented as promoters of economic growth. And finally, as suggested by Becker (1964) and Schultz (1961), in order to be efficient, education must be studied and treated as any other industry contributing to the economic growth and development of nations.

2.7 FORMAL EDUCATION: A PROMOTER OF HUMAN CAPITAL DEVELOPMENT

As stated in the previous sections, human capital is a factor with a significant impact on economic growth and development. Although human capital may be invested in many different ways, such as work experience and on-the-job training, formal education provides a pragmatic approach to human capital development. From a human capital theory's perspective, education, in general, may be defined as "the investment of current resources (the opportunity cost of the time involved as well as the direct costs) in exchange for future returns" (Harmon, et al., 2003, p. 116).

Numerous studies on investments in education provide evidence supporting the positive effects of these investments on human capital development, productivity, and growth (Carnoy, 1995b; Cohn & Geske, 1990; Harmon, et al., 2003; Johnes, 1993; Levin & Shank, 1970; Norman, 1976; Psacharopoulos, 1973). Hicks (1995), after a detailed

surveying of the available literature on human capital and growth, concluded that formal education is a major factor in improving human capital. Furthermore, Barro and Lee (2001) also concluded that human capital, "particularly that attained though education, has been emphasized as a critical determinant of economic progress" (p. 541).

Investments in education produce benefits at many levels. Lim (1996) established that investments in education contribute to economic growth in ways such as increasing the quality of the labor force, promoting the division of labor, enabling new information to be absorbed faster, leading to a more efficient allocation of resources, removing many social and institutional barriers, and encouraging entrepreneurship. Lim also suggested that in most instances, returns to investments in education "exceed the corresponding rates of return on alternative forms of investment" (p. 148). McMahon (2002) also emphasized the social benefits of investments in education and observed both, the monetary and non-monetary benefits of these investments. The social, non-monetary benefits of investments in education suggested by McMahon are increases in overall population health (i.e. reduced infant mortality, increased life expectancy), democracy, human rights and political stability, as well as benefits to the environment as a whole through reduced deforestation and pollution.

In terms of both, labor productivity and income, public expenditure in formal education is suggested to be money well spent. At the national level, Barro (1997) establishes that "an extra year of male upper-level schooling is ... estimated to raise the growth rate by a substantial 1.2 percentage points per year" (p. 19). Additionally, the Organization for Economic Co-operation and Development (OECD) has shown that for

certain countries, rising labor productivity accounted for at least half of Gross Domestic Product (GDP) per capita growth. Furthermore, and also at the national level, OECD has demonstrated that the long-term effect on economic output increases between 3 and 6 percent per additional year of formal education (2004).

When referring to the effects of education on private income, Duflo's conclusions are even more optimistic. She contended that every additional year of formal education accounts for 6 to 10 percent increase in earnings (2001). Furthermore, Sherman's report on the costs of child poverty, prepared for the Children's Defense Fund (1994), stated that, on average, each year of education increases a worker's hourly wages by 10 percent. This percentage return to investments in education is consistent with the results of studies on returns to education conducted from the 1970s (Mincer, 1974) to as recently as 2010 (Patrinos & Psacharopoulos, 2010). Investment in human capital, in the form of formal schooling has been suggested to have a positive effect on economic growth at both, the national and individual levels.

2.8 OPTIMIZING ALLOCATION OF RESOURCES IN EDUCATION: THE CONTROVERSIES

It has been suggested that investments in formal schooling have a positive impact on economic growth and development at both the national and individual levels. This conclusion begs for specific resource allocation mechanisms that work (Besley & Burgess, 2003). In other words, once it has been suggested that investments in education

produce economic growth and development, the pressing question is where in education these investments should be made.

Lim (1996), when analyzing the importance of investments in education, concludes that "[a] socially optimum educational program...requires that attention be paid to the types of education provided. This need can be seen from the different rates of return to investment in primary, secondary and tertiary education" (p. 150). Lim also suggests that "an increase in the level of educational spending on its own is not enough to produce greater economic growth. The level and the type of educational expenditure must be consistent with the demands of society and the economy" (p. 151). Judson (1998), consistent with Lim's conclusions, suggests that "the allocation to investment across levels of education can play a role in determining its effectiveness" (p. 338). Also, after controlling by country level of development, Judson observes that "countries whose allocations are inefficient...are gaining little from their investments in education" (p. 354), and concludes that "if countries want to spur growth through investment in human capital, they cannot invest indiscriminately" (p. 354). Lim and Judson clearly state that both, educational level and the specific characteristics of a country, are fundamental elements to be considered when developing and implementing policies regarding investments in education.

When attempting to address the issue of optimal allocation to resources in education, two schools of thought have emerged. Martin Carnoy, based on his analyses and observations of the United States (1975) and Korea (1993), proposed that the rates of return to investments in primary, secondary and tertiary education "will rise and fall

in this order as a country goes through various developmental stages" (Asaoka, 2006, p. iv). Moreover, according to Ryoo, Nam, and Carnoy (1993), "returns to lower levels of schooling may fall more than those to higher levels of schooling over time, especially during periods of rapid and sustained industrialization" (p. 71). "The implication is that the contribution to growth of investment in education may not only change overall as countries develop, but that investing in higher education levels may contribute more to growth when countries reach higher levels of development" (Asaoka, 2006, p. 20). In summary, according to Carnoy, as economies grow in their income level from low to middle to high, their rates of return to investments in education will grow as they move from primary, to secondary, and to tertiary.

Contrary to Carnoy's views, George Psacharopoulos, by gathering, summarizing and comparing data from the 1960s to as recently as 2006, concluded that rates of return to investments in education decline as the level of country development increases (Psacharopoulos, 1972a, 1972b, 1973, 1981, 1985, 1989, 1994, 2006). In short, according to Psacharopoulos, the rates of return to investments in education are always higher at the primary level, regardless of the particular county's level of development.

Krueger and Lindahl (2001) and Harmon and Walker (1999), as well as the United States Department of Labor (2000), among others, have observed and analyzed the different conclusions of studies on returns to education and their impact on economic growth and development. They have observed that at the micro level, the results are generally positive, whereas at the macro level, they are mixed and therefore, inconclusive. The authors presume that the different conclusions from studies on the

impact of education on economic growth are the result of inconsistencies in the data compared and the methodologies applied. These unclear conclusions demand clear answers in regards to the optimal allocations of resources in education at the international level. The following sections approach the issues of returns to investments in education, its definition, the most common methodologies used for their estimation, and provide examples of specific studies on returns to education and their conflicting conclusions.

2.9 DEFINING RATES OF RETURN TO EDUCATION

The benefits to investments in education are broad, and many times difficult to quantify. These benefits might involve, apart from the social, non-monetary ones, benefits such as wages offered, wages received, and employment (Arrazola & de Hevia, 2008). However, there seems to be a slight, but important, divide in the literature between defining and estimating returns to education. When defining returns to investments in education, most analysts observe earnings as a function of the costs incurred to obtain such earnings. When estimating returns to investments in education, rates of return are usually seen as an measurement of the future net economic payoff of increasing the amount of education taken (Carnoy, 1995a).

Measuring returns to investments in education estimate the benefits of increased education at both, the individual and the national level. The benefits of increased education at the individual level are known as private rates of return to education, and the benefits of increased education at the national level are known as social rates of

return to education. More specifically, private returns to education refer to the individual's benefits from investing in education, whereas social returns refer to the large scale benefits of such investments. Social returns also take into consideration the direct costs of schooling incurred by institutions or governments.

When calculating private and social rates of return to education based on educational level and income, attention is generally given to individual income tax payment. "Because income taxes are a cost to the individual but not to society as a whole, income should be measured after payment of income taxes when the private rate of return is estimated and before payment of income taxes when the social (economic) rate of return is estimated" (Perkins, et al., 2001, p. 335). In short, Perkins indicates that one of the main differences between private and social rates of return to education, apart from the obvious difference made by considering the cost of schooling incurred by institutions and governments when estimating social returns, is the after-tax, and before-tax calculation of earnings; private being after tax and social before. Hicks (1995), in agreement with Perkins, and when referring to private and social returns to education, stated that "the social gains will be measured as pretax income while the private gains will be net of taxes" (p. 194).

Psacharopoulos differs with Perkins and Hicks' views and argues that "contrary to popular belief, the post- versus pre-tax treatment of earnings does not make a big difference in a rate of return calculation" (1981, p. 323). In other words, according to Psacharopoulos, it is the direct costs of schooling incurred by institutions or

governments, which makes a significant difference when calculating private and social returns to education; not the pre- and post-tax measurement of earnings.

2.10 STUDIES ON RETURNS TO INVESTMENTS IN EDUCATION

Since the inception of the notion that human capital, in the form of formal education, has a significant correlation with economic growth and development, hundreds of studies have been conducted attempting to suggest the optimal allocation of resources in education. However, these studies have produced different, and sometimes contrasting, results which have resulted in controversies regarding the best possible allocation of limited resources in education. One of the major controversies in regards of where in education countries should invest in order to obtain the highest returns, is found between Martin Carnoy and George Psacharopoulos. As stated earlier on this section, Martin Carnoy (1995a) proposes that returns to investments in education vary from primary, to secondary, to tertiary as countries develop. Contrary to Carnoy's views, Psacharopoulos (1985, 1989; 2004) suggests that returns to investments in education are always highest at the primary level, regardless of the country's level of development.

2.10.1 Studies Supporting the Notion that Returns to Education Increase as the Level of Education Increases

Additional studies on returns to investments in education have continued the debate and have perpetuated the existing controversies with regards to where in education investments should be made in order to obtain the highest returns. Regarding

international and comparative studies on returns to education, Jain (1991) contended that Psacharopoulos' analyses of cross-country data provide "weak support to the declining rate-of-return hypothesis" (p. 257). Curtin and Nelson (1999) also disagreed in principle with the notion that returns to education are highest at the primary education level, and concluded that concentrating public investment on primary education will do nothing but perpetuate poverty.

Several single-country studies also support the notion that returns to education increase as the level of schooling increases. For instance, Gibson and Fatai (2006), after estimating returns to education in urban Papua New Guinea, concluded that their findings "are not consistent with the claim by Psacharopoulos (1994) that rates of return to education fall with the level of schooling" (p. 144). Additionally, Zhang and Zou (2007), based on their study of China, suggested that the returns to secondary education or above are much higher than the returns to investments in the lower levels of education. Finally, after analyzing national data on Nigeria, Amaghionyeodiwe and Osinubi (2007) also concluded that "returns to additional years of schooling completed increased as the level of education increases. In other words, returns to primary education are the lowest while those of post-secondary or higher education are the highest" (p. 164).

2.10.2 Studies Supporting the Notion that Returns to Education are Non-Linear

An "in between" posture on this debate is found by those who support the notion that that returns to investments in education are non-linear, this is, they rise and fall as

the level of education increases. For example, Trostel (2005), after estimating marginal rates of return to investment in schooling in 12 countries, argued that "the marginal rate of return is essentially nil for the first several years of schooling, it then increases rapidly until about year 12, and then it declines" (p. 192). Also, consistent with Trosel, and after estimating rates of return to education in the United States, Heckman, Lochner, and Todd (2008) suggested greater returns to investments in secondary education than to primary or tertiary.

2.10.3 Studies Supporting the Notion that Returns to Education are Highest at Lower Levels of Education

The opposite view on the debate on returns to education supports Psacharopoulos' notion that returns to investments in primary education are always the highest, regardless of the country's level of development. Consistent with this view, Schultz (1993), contended that "within countries, the general rule is for the social rate of return to decline at higher levels of education" (p. 717), and his estimates of private rates of return to investments in education in Thailand, showed investments in primary education to have the highest returns. Hossain (1997) also estimated returns to education in an Asian country: China, and also found that these returns are highest at the primary level of education. Michaelowa (2000), after observing returns to investments in education in African countries concluded that the investment in "primary education consistently shows the highest returns" (p. 7). Sakelariou (2003) estimated returns to

education in Singapore and observed that when compared with other educational levels, "overall returns to primary education are very high" (p. 78).

This section provides evidence to suggest that the controversies regarding returns to investments in education are far from being resolved. The main purpose of presenting this evidence is to justify the need for research conducted with comparable data and a sound methodology in estimating rates of return to investments in education. Additionally, the majority of these studies have not considered the individual characteristics of the countries studied (i.e. level of development). When the specific countries' level of economic development are observed, the results of studies on returns to investments in education would provide an additional perspective that would allow for the classification of returns to education for specific countries based on their individual characteristics. The conclusions of these studies will contribute to the development and implementation of sensible policies concerning the optimal allocation of resources in education based on the specific characteristics and needs of different countries.

2.11 METHODOLOGIES UTILIZED IN THE ESTIMATION OF RATES OF RETURN

A handful of methodologies have been utilized in the estimation of rates of return to investments in education. The most common are ordinary least squares (OLS), quantile regression (QR), the Heckman's two-stage selection model, instrumental variables (IV), the elaborate method, and the Mincerian equation.

2.11.1 Ordinary Least Squares (OLS)

Ordinary least squares (OLS) estimate a regression line which passes through the mean of the sample. This is to say that OLS captures the effect of education on individuals earning the average wage attributed to a particular number of years of education (Harmon, et al., 2003) (See Stock and Watson (2007) for a detailed explanation and examples of OLS estimators).

2.11.2 Quantile Regression (QR)

Quantile regression (QR), an alternative methodology to OLS, "allows us to estimate the return to education within different quantiles of the wage distribution"(Harmon, et al., 2003, p. 128). In other words, QR looks at the returns to education at particular segments of the wage distribution. This means that QR measures the returns to education of individuals with a certain level of education, as opposed to returns to particular years of education estimated through OLS. This method accounts for the so-called sheepskin effect; this is, credentials matter more than years of schooling. In other words, the specific year a diploma is received is disproportionally rewarded when compared with any other additional year of education (Gibson & Fatai, 2006). According to Harmon, Oosterbeek, and Walker (2003) QR are only necessary when "the wage return from increments in education deviates from linearity in years of education" (p. 127). (See Fitzenberger, Koenker, and Machado (2002) for a detailed explanation of the quintile regression method).

2.11.3 Heckman's Two-Stage Selection Model

Both, the OLS and QR methods for estimating returns to investments in education have the sample selectivity problem resulting from data on wages observed only for people who are in wage employment (Serumaga-Zake & Kotze, 2003). In order to adjust for this predisposition, the Heckman's two-stage selection model for estimating returns to education "involves a two-stage procedure for which [first,] the probability that an individual will be employed is determined according to a probit regression function using personal variables (e.g. wealth index, parents' education, relationship to household head, age and education) as regressors" (Serumaga-Zake & Kotze, 2003, p. 104). The "second stage" of this method consists of the inclusion of the probability of employment term (the "selectivity correction" variable) in the wage function. The two major limitations of the Heckman's two-stage selection model is that it may fail to address the joint-decision selection problem that concerns two hurdles: labor supply (whether the individual chooses to be employed or not) and employment (whether the individual chooses to work for an offered wage, or a particular job) (Serumaga-Zake & Kotze, 2003). For an application of the Heckman's two-stage selection model see Seruma-Zake & Kotze (2003).

2.11.4 Instrumental Variables (IV)

The instrumental variables IV method for estimating returns to investments in education examines how wages differ between groups whose education is different for

exogenous reasons (Harmon, et al., 2003). Put simply, the IV method provides a solution to the problem of wages being affected by not only education, but also by the combined effect of education and other variables originated externally, such as proximity to schools and compulsory school laws. The instrumental variables method accounts for the existence of these variables in its estimation of returns to investments in education (See Card (2001) for an application of the instrumental variables method).

2.11.5 The Elaborate Method

The elaborate method, or the discounting of actual net age-earnings profile, is an appropriate method for estimating returns to education since it follows from the algebraic definition of the rate of return (which equates a stream of benefits to a stream of costs at a given point in time). The limitations of the elaborate method are that it requires detailed data on age-earnings profiles by educational level and these data are difficult to come across in most countries (See Psacharopoulos (1981) for a details and examples of the elaborate method).

2.11.6 The Mincerian Equation

The Mincerian equation for estimation of rates of returns to education calculates rates of return to schooling via multiple regression analysis (Hough, 1993). According to Björklund and Kjellström (2002), the Mincerian equation, "which relates the logarithm of earnings to schooling, years of work experience and years of work experience squared, is one of the most commonly estimated relationships in labor

economics" (p. 195). Some of the most important reasons for the popularity of the Mincerian equation are "the pragmatic use of results from human-capital theory to derive an estimating earnings equation, and also that the schooling coefficient obtained through the method, is closely related to the marginal (and in the linear case, also the average) internal rate of return to education" (p. 195). Despite the Mincerian equation limitations, if simplicity is called for in an analysis of the impact of schooling and work experience on wages, the Mincerian equation is definitely hard to beat (Björklund & Kjellström, 2002). (See Mincer (1974) for a detailed explanation and examples of the Mincerian equation).

2.12 TWO METHODS FOR ESTIMATING RETURNS TO INVESTMENTS IN EDUCATION BASED ON THE MINCERIAN EQUATION

The most frequently used methodologies for estimating returns to education based on the Mincerian Equation are the earnings function and short-cut methods. The earnings function method estimates private returns to education through a regression of logged earnings on years of schooling, years of experience and years of experience squared. The returns to education are estimated based on the regression coefficients on schooling. On the other hand, the short-cut method estimates private returns to education solely as the proportion of earnings and years in schooling. It is important to reiterate that Mincer's proposition has been widely referenced since its inception in the 1970s, and has been accepted as a standard method for the estimation of rates of return to

investments in education (Asaoka, 2006; Heckman, Lochner, & Todd, 2003; Patrinos & Psacharopoulos, 2010; Psacharopoulos, 1981).

2.12.1 The Earnings Function Method

The earnings function method for estimating returns to education is a regression of the basic form:

$$\ln Y_i = a + b \cdot S_i + c \cdot EX_i + d \cdot EX_i^2 \tag{2.4}$$

where *Y* represents the wages of individual (*i*), *S* is years of schooling, and *EX* years of labor market experience. (Mincer, 1974; Psacharopoulos, 1995). Experience as a quadratic term (i.e., EX^2) captures the nonlinear relationship between earnings and experience: Earnings tend to increase in the early years after entering the labor market, flatten, and decrease through time (Gunderson & Oreopoulos, 2010, p. 38; Harmon, et al., 2003).

The *b* coefficient in equation (1) can be interpreted as the private rate of return to one extra year of schooling (*r*), provided that other costs are negligible:[1]

$$b = \frac{\partial \ln Y}{\partial S} = \left[\frac{Y_z - Y_x}{Y_x} \right] \frac{1}{\Delta S} = \frac{Y_z - Y_x}{Y_x \cdot \Delta S} = r \tag{2.5}$$

[1] The relative change in earnings following a change in schooling is the rate of return only when forgone earnings are the only cost of education.

where $\partial \ln Y$ is the relative change in earnings, and ∂S is a given change in schooling, and Y_z and Y_x the earnings of those with z and x years of schooling, z being the individual's highest year of education, and x its immediate lower year. It is important to clarify that r can be considered, given the assumptions and limitation of this model, as both, the private financial return to schooling (assuming no tuition or other costs), and as the proportionate effect on wages of an increment to S (Gunderson & Oreopoulos, 2010; Harmon, et al., 2003; Psacharopoulos, 1981).

An important limitation of this approach is the assumption that rates of return are the same for all levels of schooling; making it difficult to settle the problem of allocation of resources to different educational levels. Additionally, when estimating returns to an additional year of education, this approach to estimating returns to education assumes the returns to be the same, regardless of the educational level. Nevertheless, an additional year of a higher level of education has the potential of yielding higher returns than an additional year of education in a lower level of schooling. Also returns to the year previous to a completed level of education have been observed to be lower than the returns of the year in which a level is completed; the sheepskin effect (Heckman, Lochner, & Todd, 2006; US Department of Labor, 2000).

In view of these shortcomings, it is possible to incorporate an *educational level* dimension to the rate of return concept. Incorporating educational levels can be accomplished by means of a series of dummy variables (i.e. PRIM, SEC and TERT) to

the earnings function model (Psacharopoulos, 1981).[2] The resulting regression function is as follows:

$$\ln Y = a + b \cdot PRIM + c \cdot SEC + d \cdot TERT + e \cdot EX + f \cdot EX^2 \quad (2.6)$$

from which returns by educational level can be estimated. The rates of return to the different levels of education, relative to their immediate lower level, are derived from the estimated coefficients of *b*, *c* and *d* in the function, and are:

$$r_{(primary\ vs.\ illiterates)} = \frac{b}{S_p} \quad (2.7)$$

$$r_{(secondary\ vs.\ primary)} = \frac{c - b}{S_s - S_p} \quad (2.8)$$

$$r_{(tertiary\ vs.\ secondary)} = \frac{d - c}{S_t - S_s} \quad (2.9)$$

[2] An alternative approach to adding an educational level dimension to the rate of return concept is to add an $e \cdot S^2$ term in equation (2.4), where *e* is the estimated coefficient on years-of-schooling-squared. In this case, differentiation with respect to *S* yields

$$r = b + 2eS$$

By substituting different values of *S* in the right-hand side of this equation, one can arrive at a regression-based rate of return structure corresponding to the different *levels* of education (i.e., to primary education *S=6*, secondary education *S=12*, to tertiary education, *S=16*) (Psacharopoulos, 1981).

where *S* stands for the number of years of schooling of the subscripted educational level (*p* = primary, *s* = secondary, *t* = tertiary) (Psacharopoulos, 1981).

2.12.2 The Short-Cut Method

In essence, the short-cut method is a simplified version of the earnings function method, and estimates private returns to education under the assumption that earnings are strictly proportional to the number of years spent in school (Mincer, 1974). Social returns to education are estimated by incorporating costs of education to the denominator of the equation.

Private returns to education are estimated, according to the short-cut method, as mathematical approximations to the *b* coefficient in the earnings function regression (see equation 2.6):

$$_{private}r_k = \frac{\overline{Y}_k - \overline{Y}_{(k-\Delta s)}}{S_k \cdot \overline{Y}_{(k-\Delta s)}} \tag{2.10}$$

Where $_{private}r_k$ is the private rate of return to investment in *k* level of education, $\overline{Y}_k$ is the mean earnings of individuals with a completed *k* level of education, Δ_s is the difference in years of schooling between *k* and the immediate lower level of education and S_k is the number of years in the subscripted educational level.

Social returns to investments in education are estimated through the following equation:

$$_{social}r_k = \frac{\overline{Y}_k - \overline{Y}_{(k-\Delta s)}}{S_k \cdot (\overline{Y}_{(k-\Delta s)} + C_k)} \tag{2.11}$$

where C_k is the public expenditure per pupil in k level of education.

In order to improve the estimates of returns to the primary level of education, a *preprimary* level of education may be introduced. This was the approach followed on the estimation of returns to education in this study. An accurate estimation of returns to primary education via the short-cut method is possible only when data on wages for individuals with less than a completed primary level of education are available; virtually inexistent for developed countries, but available for less developed countries, where a higher percentage of the working force might not have a completed primary level of education. The years of education and income of individuals with less than a completed primary level of education can then be compared against those of individuals with a completed primary level of education. This additional preprimary educational level would allow for greater accuracy in the estimation of returns to primary education.

2.13 LIMITATIONS OF ESTIMATING RETURNS TO EDUCATION THROUGH THE METHODS BASED ON THE MINCERIAN EQUATION

The Mincerian Equation, as a mean to estimating returns to education, is certainly not flawless. This method's inadequacies are clear and well documented. Among the most commonly observed are that:

- Individuals with fewer years of education than the average person will be assigned higher returns than the estimated average return.
- It assumes that individuals forgo earnings at all points during their education.
- It ignores important variables influencing the decision to pursue additional education.
- The coefficient on schooling in a regression of logged earnings on years of schooling is often erroneously called a rate of return.

2.13.1 Individuals with Fewer Years of Education than the Average Person Will Be Assigned Higher Rates of Return than the Estimated Average Return

When estimating returns to an additional year of schooling, the Mincerian Equation does not consider the notion that individuals with lower levels of education will be assigned higher returns than individuals with the average years of schooling in the sample. This is due to the fact that their income is most likely lower, and thus, their actual return to an extra year of schooling also lower than that of an individual with more education. The opposite is true for those individuals with the highest levels of education in the sample. Because of their likely higher income levels, these individuals will be assigned lower returns per year of schooling than the individual with the -lower- average level of education.

When incorporating an educational level component to the Mincerian Equation, the model considers given numbers of years of schooling to represent educational levels

(i.e., primary = 6, secondary = 12, tertiary = 16). In this case, individuals with the minimum required years for a given level (i.e., 12 for secondary education) will be assigned the same return than those individuals with more schooling than the required by the particular level (let's say, 14), but who have not completed the following educational level (tertiary = 16). This is the result of the Mincerian Equation assuming the same returns to all individuals with the same completed level of education, regardless of how close is the individual to the completion of the subsequent educational level (Heckman, et al., 2006; US Department of Labor, 2000). Although present, the issue of individuals with higher (or lower) educational levels than the average individual in the sample assigned lower (or higher) returns might be addressed and minimized through the incorporation of an educational level component to studies on returns to education.

2.13.2 It Assumes that Individuals Forgo Earnings at All Points during Their Education

The assumption that individuals forgo earnings at all points during their education is impacted by the average level of education of the particular country for which returns are estimated. For instance, the forgone earnings of young children in economies with high levels of educational attainment are small and, therefore, the calculated rate of return is not likely to be much higher than it should be. On the other hand, in economies with low educational attainment, young children's foregone earnings are likely to be high, underestimating the true rate of return (US Department of Labor, 2000).

This fact may be observed as children in economies with high levels of educational attainment are not very likely to enter the workforce, and consequently, not likely to forgo earnings during their initial years of education. On the other hand, and contrary to children in developed nations, children in economies with lower educational attainment levels are more likely to enter the workforce at an earlier age, and thus, forgo earnings as a part of their investment in education. The forgone earnings of individuals during their education are likely to be correlated to the particular country's level of educational attainment. Overall, returns to education tend to be lower when educational attainment is high; prevalent in developed nations. The returns tend to be higher when educational attainment is low, particularly at the lower end of the wage distribution; most frequently observed in less developed countries (Moffitt, 2007; Patrinos & Psacharopoulos, 2010). The issue of individuals forgoing earnings at all points during their education might be addressed through the careful interpretation of the results and through the integration of an economic development level component to studies on returns to education at the international level.

2.13.3 It Ignores Important Variables Influencing the Decision to Pursue Additional Education

Mincer coefficients ignore psychic costs of education, uncertainty, the value of schooling and sequential revelation of information, and the option value of schooling (Heckman, et al., 2006). As psychic costs and uncertainty are ignored by the Mincerian equation model, the rates of return estimated through the method are upward biased,

making it necessary to adjust for this unaccounted variable in the model. The value of schooling and sequential revelation refers to the notion that decisions are made sequentially as information is made available with every extra year of education, allowing for a sequential resolution of uncertainty. This is a return to increased levels of education not taken into account by the Mincerian model. Finally, the option value of schooling observes how the completion of a particular level of education generates the option of pursuing the following educational level. It is suggested that part of the return to completing a particular level of education -not contemplated by the Micerian equation- is the option of initiating, and completing, the following educational level (Heckman, et al., 2003).

2.13.4 The Coefficient on Schooling in a Regression of Log Earnings on Years of Schooling is Often Erroneously Called a Rate of Return

The coefficient on schooling alone in a regression of log earnings on years of schooling is the proportional change in earnings resulting from a change in one year (or level) of schooling and not a rate of return (Heckman, et al., 2006). The coefficient on schooling can be considered a rate of return only when forgone earnings are the only cost of education. It is clear that the coefficient of schooling alone does not represent the rate of return. In order to address this issue, and integrate an opportunity cost to the estimation of the returns (i.e. forgone earnings), the rate of return must be estimated considering the coefficient of the immediate lower level of education and the difference in years of schooling between the observed level and its immediately lower level. See

equation 2.6, from which returns to education can be estimated in relation to coefficients of schooling.

All of these are real issues limiting the proper estimation of returns to education. However, these issues have yet to be sorted out, measured and explained by the current literature on returns to education. These issues will only be resolved with the availability of richer data (Heckman, et al., 2008); currently unavailable for less developed countries.

2.14 SUBSTITUTION OF THE EARNINGS FUNCTION METHOD BY THE SHORT-CUT METHOD

It is clear that estimating returns to education through the earnings function method is a more data-rich strategy than it is to estimate the same returns using the short-cut method. Nonetheless, when applying different methods to the estimation of returns to education, the conclusions tend to be similar. The difference in results lays on the specificity and comparability of the data utilized in the estimation of these returns; data often incomplete and thus, unreliable (Psacharopoulos & Patrinos, 2004; Tsang, 1988).

Menon (1997, 2008) estimated perceived rates of return to higher education in Cyprus, using both the elaborate and short-cut methods for estimation of returns to education. She concluded that the results were similar enough to support the notion that the short-cut method may be used as a substitute for the elaborate method when data for the estimation of returns through the elaborate method are not available. Furthermore,

Mincer stated that the proper implementation of the short-cut method gives rise to a rough but useful, quick, and easy method for assessing rates of return to schooling. Also, Mincer's estimates of rates of return to schooling in 1939, 1949 and 1958 using both the earnings function and the short-cut methods are relatively close, suggesting the practicality of the short-cut estimation. Despite the limitations of the shot-cut method, it is still an appropriate way to estimate and compare returns to education at the international level, especially when less developed countries are included on these estimations.

Ultimately, data availability tends to be the decisive factor when selecting the methodology to be used in estimating returns to investments in education. And even though other methods have been perceived as better when compared with the short-cut method, the data required for their implementation is often unavailable. When attempting to estimate international returns to investments in education, particularly in less developed countries, data tends to be limited. And even though more advanced models might be more accurate in the estimation of rates of returns, unfortunately, they are ineffective when estimating returns to education in countries with deficient data (i.e., less developed countries). These countries tend to be in the regions of the world with the greatest need for sound policies regarding cost-efficient investments of resources in education.

2.15 OTHER CONSIDERATIONS IN ESTIMATING RETURNS TO EDUCATION

2.15.1 Endogeneity of Educational Attainment

Estimates on returns to education seldom account for individual predispositions that make schooling choices vary across the general population. Some of these predispositions may be attributed to individual ability, access to wealth, and parents' education. These elements may bias the returns to education upwards when individuals possess high ability, wealth, and educated parents. The opposite may be observed when ability and wealth are minimal and parents are holders of lower levels of education. This is a critical issue that must be addressed, particularly in low income economies where poverty and family conditions prevent individuals from academic success, resulting in a vicious cycle of poverty.

Individual ability, wealth and family background have a significant effect on educational attainment (R. J. Barro & Lee, 2001; Heckman, et al., 2008). This is of particular concern in less developed countries, where access to education is limited; the result of a lack of the necessary infrastructure and financial framework for its provision. In this context, individuals with higher predispositions towards education are most likely to obtain its benefits, making observations on returns to education biased in their findings.

Attempts to approach the problem of endogeneity of educational attainment have been made by controlling for ability with the purpose of observing the effects of education on wages. Some of these studies involve measuring wage differences in twins

or siblings with different wages and levels of education. Clearly, the main assumption is that twins or siblings raised in similar conditions have the same ability and consequently, their wages are determined by their level of education alone (Card, 2001; Harmon, Hogan, & Walker, 2001; Harmon, et al., 2003; Katz & Autor, 1999; US Department of Labor, 2000).

2.15.2 Exogenous Factors Impacting Educational Attainment

Exogenous variables influencing estimates on returns to education have also been observed. Among these, quality of education, compulsory education laws, distance to school, density of students per school, improved health of children, and improved civic participation have been observed. Studies have been conducted with the purpose of controlling for these exogenous factors influencing returns to education (Card, 1995; Currie & Moretti, 2003; Dee, 2004; Duflo, 2001; Hanushek & Zhang, 2009; J. W. Lee & Barro, 1997; Leigh & Ryan, 2008; Salas, 2004).

When estimating returns to education at the international level, it is important to consider the differences in conditions prevalent in countries at different levels of economic development. For instance, unlike less developed countries, developed countries have a more stable infrastructure and institutions providing greater opportunities for educational attainment, particularly, laws against child labor, and compulsory education laws promoting a more unrestricted access to education.

2.16 CONCLUSION

Through this section, general view of the literature on economic growth and development was provided. Also, an abbreviated version of the historical evolution of growth theories was presented. Then, the major factors contributing to economic growth and development were reviewed. Evidence was provided to suggest that human capital is a major variable in the promotion of economic growth and development, and that it is suggested to be a pre-condition for growth. Then, a general view on human capital theory followed by literature proposing formal education as a promoter of growth was presented. Next, the major controversial views concerning the optimal allocation of resources to education were illustrated, and definitions for rates of return to education were provided. Subsequently, through this section, brief presentation of the most frequently used methodologies to estimate these rates of return in education was conducted, and the major views and conclusions of studies on these investments were presented. Then, literature substantiating the substitutability of the two methodologies derived from the micerian equation; the earnings function and the short-cut methods, was presented. Lastly, endogenous and exogenous variables impacting the estimating of returns to investments in education were introduced.

The notion of returns to education has recently gained a renewed level of attention (Card, 2001; Katz & Autor, 1999; Psacharopoulos & Patrinos, 2004). Modern statistical tools and data availability have been major contributors to this renewed interest in the estimation of returns to investments in education. Moreover, “increasingly, governments and other agencies are funding studies of returns to

education along with other research, to guide macro-policy decisions about the organization and financing of education reforms" (Psacharopoulos & Patrinos, 2004, p. 118). This dissertation is written with the expectation to substantially contribute to the recent approaches to policy development and implementation concerning returns to education.

3. METHODOLOGY

3.1 INTRODUCTION

A major component of this research is to determine whether there is a significant difference among returns to investments in education in countries at different levels of economic development. Given the fact that countries with lower income levels lack the necessary data to estimate returns to education using data-rich methodologies, it was necessary to find a methodology that could be used in the estimation of returns to education for less developed countries, at the same time that it is shown to be reliable for the estimation of these returns. The short-cut method for estimating returns to education based on the Mincerian equation has been suggested to be a viable and reliable method for the estimation of returns when faced with the challenge of data availability.

Initially, in this section, the analytical techniques applied on this dissertation are presented. The analytical techniques are classified in two groups: Those applied in the preliminary study aiming to suggest the viability of the short-cut method for estimation of returns to education, and the analytical techniques applied in the estimation of returns to education for 59 countries at different levels of economic development. Analytical techniques applied to observe the statistical significance of the differences among returns to education for countries at different levels of development are also presented in this section.

Secondly, the data utilized in both, the preliminary study suggesting the viability of the short-cut method, and the data used in the study estimating returns for 59

countries are presented. The operationalization of the data is also presented in this section. The operationalization of the data also accounts for the linking of data on wages by employment type and data on wages by level of education. This was accomplished through the linking of the classifications provided by the International Standard Classification of Occupations (ICSO) with the International Standard Classification of Education (ISCED).

Lastly, this section presents the preliminary study which was conducted with the purpose of observing whether Menon's (1997, 2008) and Mincer's (1974) conclusions regarding the existing correlation between results yielded by the elaborate and the earnings function methods with the short-cut method hold true when tested in a group of countries with sufficient data availability. Returns were preliminarily estimated for 28 countries with enough data available through both, the earnings function and the short-cut methods. This preliminary study was conducted with the purpose of suggesting that the earnings function for estimating returns to education may be substituted by the short-cut method; particularly when research is limited by data availability.

3.2 ANALYTICAL TECHNIQUES

3.2.1 Analytical Techniques Applied in the Preliminary Study Estimating and Comparing Returns to Education for 28 Countries through the Earnings Function and Short-Cut Methods

A preliminary study was conducted with the purpose of suggesting the significant correlation between the results yielded by the earnings function and the short-cut

methods for estimating returns to education. The results of this preliminary study suggested a significant correlation between the results yielded by the two methods. This was accomplished through the estimation of returns for 28 countries with sufficient data available to conduct the study. Once the validity of the short-cut method was suggested, returns to investments in education were estimated via the short-cut method for 59 countries with different levels of economic development.

3.2.1.1 *Analytical Techniques Applied in the Preliminary Estimation of Private Returns to Education in 28 countries through the Earnings Function Method*

Initially, private returns to education through the earnings function method were estimated for 28 countries with data available by way of the function:

$$\ln Y = a + b \cdot PRIM + c \cdot SEC + d \cdot TERT + e \cdot EX + f \cdot EX^2 + g \cdot FEMALE + h \cdot MARRIED + i \cdot UNION + j \cdot PUBLIC + k \cdot YR + l \cdot e \quad (3.1)$$

Where Y represents individual wages, *PRIM, SEC* and *TERT* are educational level dummy variables (with the purpose of adding a level of education component to the analysis), *EX* represents years of experience, and EX^2 years or experience squared. *FEMALE*, *MARRIED*, *UNION* and *PUBLIC* are dummy variables for gender, marital status, union employed and public or private employment. *YR* represents year, with *e* as the error term. Also *PREPRI* represents the dummy variable for a "preprimary" level of education; category omitted in order to avoid multicolinearity (Kennedy, 1979). The

regressors *FEMALE*, *MARRIED*, *UNION*, *PUBIC* and *YEAR* were included in the model for controlling purposes of variables which might have an effect on wages, thus making the regression specification stronger. This was done since accounting -or controlling- for additional explaining variables allows for a more accurately captured influence of the variable(s) under consideration (Kennedy, 1979; Stock & Watson, 2007).

3.2.1.1.1 *Addressing the Assumptions of OLS Methodologies*

The preliminary study was conducted with an already existing dataset provided by the ESRC Data Archive at the University of Essex through Professor Ian Walker. In order to address the possible violation of the assumptions of homoskedasticity and linearity made by ordinary least square (OLS) estimation in this dataset, robust regression analyses were applied in the study. A robust estimator is one "whose desirable properties are insensitive to departures from the assumptions under which it is derived" (Kennedy, 1979, p. 24). In a robust regression estimate, outliers are weighted less than more central observations. This way, extreme observations have less effect on the regression estimates (Acock, 2006). Also, it is necessary to clarify that potential violations of linearity and homoskedasticity in OLS estimates "merely weaken the regression analysis, but do not invalidate it" (Mertler & Vannatta, 2005, p. 174). The dataset provided by the University of Essex is purely a tool utilized as a part of a preliminary study comparing returns to education estimating through both, the earnings function and the short-cut methods. This preliminary study attempts to validate the use

of the short-cut method for estimation of returns to education when data availability is limited.

3.2.1.1.2 *Estimating Returns through the Earnings Function Method*

Once the regression analysis was conducted, the coefficients for primary, secondary and tertiary education were applied to the estimation of returns to the different educational levels through the following specifications:

$$r_{(primary\ vs.\ illiterates)} = \frac{b}{S_p} \tag{3.2}$$

$$r_{(secondary\ vs.\ primary)} = \frac{c - b}{S_s - S_p} \tag{3.3}$$

$$r_{(tertiary\ vs.\ secondary)} = \frac{d - c}{S_t - S_s} \tag{3.4}$$

where r is the estimated rate of return, b, c and d are the coefficients for primary, secondary and tertiary education, and S stands for the number of years of schooling of the subscripted educational level (p = primary, s = secondary, t = tertiary) (Mincer, 1974; Psacharopoulos, 1981).

3.2.1.2 *Analytical Techniques Applied in the Preliminary Estimation of Private Returns to Education in 28 Countries through the Short-Cut Method*

Private returns to education for the same 28 countries were estimated via the short-cut method via the following equation:

$$_{private}r_k = \frac{\overline{Y}_k - \overline{Y}_{(k-\Delta s)}}{S_k \cdot \overline{Y}_{(k-\Delta s)}} \tag{3.5}$$

where $_{private}r_k$ is the private rate of return to investment in k level of education, $\overline{Y}_k$ is the mean earnings of individuals with a completed k level of education, Δ_s is the difference in years of schooling between k and the immediate lower level of education and S_k is the number of years in the subscripted educational level (Mincer, 1974; Psacharopoulos, 1981).

3.2.1.3 *Analytical Techniques Applied in the Preliminary Study Comparing Returns to Education through Both, the Earnings Function and the Short-Cut Methods*

In this preliminary study, returns to education estimated through the earnings function and short-cut method were compared by estimating correlation coefficients (r) and coefficients of determination (R^2) to suggest the existence of a significant correlation between the results yielded by both methods and the percentage of the results yielded by one method that can be explained by the other.

3.2.2 Analytical Techniques Applied in the Estimation and Analysis of Private and Social Returns to Education in 59 Countries at Different Levels of Economic Development through the Short-Cut Method

Private returns to education for the same 59 countries with different levels of economic development were estimated via the short-cut method:

$$_{private}r_k = \frac{\overline{Y}_k - \overline{Y}_{(k-\Delta s)}}{S_k \cdot \overline{Y}_{(k-\Delta s)}} \tag{3.6}$$

where *private* r_k is the private rate of return to investment in k level of education, $\overline{Y}_k$ is the mean earnings of individuals with a completed k level of education, Δ_s is the difference in years of schooling between k and the immediate lower level of education and S_k is the number of years in the subscripted educational level (Mincer, 1974; Psacharopoulos, 1981).

Social returns to investments in education were estimated for 59 countries with different levels of economic development through the short-cut method:

$$_{social}r_k = \frac{\overline{Y}_k - \overline{Y}_{(k-\Delta s)}}{S_k \cdot (\overline{Y}_{(k-\Delta s)} + C_k)} \tag{3.7}$$

where *social* r_k is the social rate of return to investment in *k* level of education, $\overline{Y}_k$ is the mean earnings of individuals with a completed *k* level of education, Δ_s is the difference in years of schooling between *k* and the immediate lower level of education and S_k is the number of years in the subscripted educational level, and C_k is the public expenditure per pupil in *k* level of education (Mincer, 1974; Psacharopoulos, 1981).

3.2.2.1 *Analytical Techniques Applied to the Analysis of the Differences in Private Returns to Education at Different Educational Levels and for Countries at Different Levels of Economic Development*

In order to analyze the observed differences in returns to education at different educational levels and for countries at different levels of economic development, analyses of variance (ANOVA) were utilized to suggest whether the observed differences were statistically significant. When statistically significant differences between levels of education or levels of development were found, post-hoc pairwise comparisons were performed to determine where the statistically significant differences between educational levels and levels of development were found. For this study, given its "middle of the road" approach to pairwise comparisons when contrasted with liberal Sidak and conservative Scheffe, Bonferroni post-hoc pairwise comparisons were selected.

3.3 THE DATA

3.3.1 Data Utilized in the Preliminary Study Estimating Returns to Education for 28 Countries through Both, the Earnings Function and Short-Cut Methods

The data utilized in the preliminary study comparing returns to education estimated through the earnings function and short-cut methods, were made available by the International Social Survey Program (ISSP) from 1985 to 1995. The data were provided by the ESRC Data Archive at the University of Essex through Professor Ian Walker (P. Trostel, Walker, & Woolley, 2002). ISSP data are gathered from national surveys using a common questionnaire designed to be consistent with each other and thus, broadly comparable. The data consists on a core of questions that includes general information on earnings, education, gender, marital status, and type of employment among other questions that might vary depending on the focus of the particular year's survey. The data were designed for qualitative analysis and it is likely that there may be errors in measurement, particularly in earnings and schooling; key components of this study (Harmon, et al., 2001; Harmon, et al., 2003; P. Trostel, et al., 2002). See Table 3.1 for summary statistics of the data used in the preliminary study. Also, see Appendix 1 for summary statistics by country and year of the data used in the preliminary study.

Table 3.1 Summary Statistics of Data Used in the Preliminary Study
All Countries and Years

Country = All, Year = 1985-1995

Variable	Obs	Mean	Std. Dev.	Min	Max
log of wages (lnY)	60929	5.551145	1.904011	-2.902794	12.42922
primary	60929	.4328481	.4954742	0	1
secondary	60929	.3983981	.4895723	0	1
tertiary	60929	.1597761	.3664013	0	1
exp	60929	22.0342	10.86268	0	55
exp2	60929	603.5021	521.7653	0	3025
female	60929	.4645079	.4987428	0	1
married	60929	.6947923	.4604991	0	1
public	51514	.5086578	.4999299	0	1
union	60929	.4489652	.4973927	0	1
year	60929	1991.401	2.879034	1985	1995

3.3.1.1 *Operationalization of the Data Utilized in the Preliminary Study*

The data provided by ISSR presented inconsistencies in the terms on which earnings were reported (i.e., weekly, monthly, and annually). Data were adjusted for weekly earnings through the division of the income reported by either 4 or 52 when necessary. Also, dummy variables *PREPRI*, *PRIM*, *SEC* and *TERT* account for *attained* educational levels based on years of schooling were estimated: $PREPRI < 6$ for preprimary and incomplete primary, $6 \leq PRIM < 12$ for primary and incomplete secondary, $12 \leq SEC < 16$ for secondary and incomplete tertiary, and $TERT \geq 16$ for complete tertiary. See Table 3.2 for a reference on years for attained educational levels based on years of schooling utilized in this study.

Table 3.2 Representation of Years per Attained Educational Level Based on Years of Schooling Utilized in the Study.

Educational Level	Years			
PREPRI	<	6		
PRIM	≥	6	<	12
SEC	≥	12	<	16
TERT	≥	16		

It is important to emphasize that data adjusted for wages per week presented outliers for the United States in 1991, the Netherlands in 1995, Ireland in 1989, Norway in 1989, 1990 and 1991 and Russia in 1994 and 1995. In order to adjust for potential data collection and measurement errors, and increase the robustness of the data, values five standard deviations above and below the mean of weekly earnings were removed from the sample prior to conducting this study. The decision to remove data five standard deviations from the mean was made based on the fact that the outliers observed were sparse and rather extreme (See Appendix 2).

Also, data on Great Britain and Northern Ireland do not provide figures on incomplete primary levels of education nor for completed tertiary levels of education. Given their level of development and education rates, this is unlikely to be observed in a random selection of individuals in these countries. Consequently, it biases returns to an *additional year* of schooling for these countries.

As part of the preliminary study, returns to the different educational levels were estimated accounting for both, observed average years of schooling per educational level per country, and for the international standard classification of education that estimates 6 years to primary education, 12 to secondary and 16 to tertiary. Returns were estimated in this manner with the purpose of addressing the issue of individuals with higher (or lower) years of education assigned lower (or higher) returns than the average individual in the particular educational level.

3.3.2 Data Utilized in the Study Estimating Returns to Education for 59 Countries at Different Levels of Economic Development

Data on wages between 1997 and 2007 were gathered from LABORSTA. LABORSTA is the International Labor Organization (ILO) database on labor statistics operated by the ILO Bureau of Statistics. Data on wages were classified by occupational type according to the international standard classification of occupations. Data were arranged by occupational type in order to estimate average wages by occupational type by country by year. For instance, data on wages for different types of operators and assemblers (i.e. plant and machine) were grouped together for each year for every country. The result was the average wages for plant and machine operators and assemblers per country per year. The same procedure was applied to every occupational type available through ILO, resulting in average wages per occupational type per country per year. Data between 1997 and 2007 were gathered for this study.

3.3.2.1 *Linking Occupational Types to their Corresponding Years of Education*

LABORSTA's data are available as wages earned by *occupational type*. However, since the methodology utilized in this study (The short-cut method based on Mincer's proposition for the estimation of rates of return to investments in education), requires wages by *years of education* as one of its components, it will be necessary to bridge the gap between occupational type and level of education. To accomplish this, data from the International Standard Classification of Occupations (ISCO) and the International Standard Classification of Education (ISCED) were utilized.

3.3.2.1.1 *International Standard Classification of Occupations*

In order to help countries improve their labor administration as well as the quality, reliability and comparability of their labor statistics, the need for an International Standard Classification of Occupations (ISCO) was first discussed in 1923 at the first International Conference of Labor Statisticians (ICLS). However, it was not until 1949 that the Seventh ICLS adopted a provisional classification of nine major occupational groups. In 1957 the work was completed by the endorsement of major, minor and unit occupational groups of the first ISCO. The first ISCO was published in 1958 as ISCO-58 and included, in addition to the group definitions, descriptions of 1,345 occupational categories within each unit group. The third and most recent version, ISCO-88 was adopted by the Fourteenth ICLS in November of 1987 and approved by ILOs Governing Body in February 1988.

ISCO-88 defines four levels of aggregation for occupations, consisting of major groups, sub-major groups (subdivisions of major groups), minor groups (subdivisions of sub-major groups), and unit groups (subdivisions of minor groups). Unit groups will consist of a number of detailed occupations. For example, as a separate occupation, nuclear physicist belongs to ISCO-88 unit group 2111 (physicists and astronomers), which belongs to minor group 211 (physicists, chemists and related professionals), which is a part of sub-major group 21 (physical, mathematical and engineering science professionals) of the major group 2 (professionals). Eight of the ten ISCO-88 major groups are delineated with reference to four broad skill levels. See Table 3.3 for an aggregation of occupational groups and their corresponding skill level.

Skill level references are not made in the definitions of the two major groups entitled Legislators, Senior Officials and Managers, and Armed Forces respectively, because other aspects of the type of work were considered more important (i.e. policy making and management functions, and military duties, respectively). As a result, there are significant skill level differences of the jobs classified to each of these two major groups.

Table 3.3 ISCO-88 Aggregation of Occupational Groups and Their Corresponding Skill Level.

Major Groups		Sub-major Groups	Minor Groups	Unit Groups	Skill Level
1	Legislators, Senior Officials and Managers	3	8	33	–
2	Professionals	4	18	55	4th
3	Technicians and Associate Professionals	4	21	73	3rd
4	Clerks	2	7	23	2nd
5	Service Workers and Shop and Market Sales Workers	2	9	23	2nd
6	Skilled Agricultural and Fishery Workers	2	6	17	2nd
7	Craft and Related Workers	4	16	70	2nd
8	Plant and Machine Operators and Assemblers	3	20	70	2nd
9	Elementary Occupations	3	10	25	1st
10	Armed Forces	1	1	1	

Source: ISCO *International statistical comparisons of occupational and social structures: Problems, possibilities and the role of ISCO-88* by Eivind Hoffmann

3.3.2.1.2 *International Standard Classification of Education*

The International Standard Classification of Education (ISCED) was designed by the United Nations Educational Scientific and Cultural Organization (UNESCO) in the early 1970s to serve as an instrument suitable for assembling, compiling and presenting comparable indicators and statistics of education both within individual countries and internationally. It was approved by the International Conference on Education in Geneva, 1975, and was subsequently endorsed by UNESCO's General Conference when it adopted the revised recommendation concerning the International Standardization of Educational Statistics in its twentieth session in Paris, 1978.

The present classification, now known as ISCED 1997, was approved by the UNESCO General Conference at its 29th session in November of 1997. It was prepared by a task force established by the Director-General, and is the result of extensive consultations of worldwide representation. The basic concept and definitions of ISCED have been designated to be universally valid and invariant to the particular circumstances of a national education system. In other words, ISCED may function as a methodology that translates national educational programs into an internationally comparable set of categories; it facilitates the transformation of detailed national educational statistics into aggregate categories that are internationally comparable and that can be meaningfully interpreted. The basic unit of classification in ISCED is the educational program. Educational programs are defined on the basis of their content as an array or sequence of educational activities which are organized to accomplish a pre-

determined objective or a specified set of educational tasks. ISCED 1977 classifies educational programs as follows:

- Level 0, Pre-primary education.

  This level corresponds to the initial stage of organized instruction. Upon completion, children continue their education at level 1.

- Level 1, Primary education.

  The programs at this level cover in principle six years of full-time schooling.

- Level 2, Lower secondary education.

  The end of this level is after nine years of schooling since the beginning of primary education.

- Level 3. Upper secondary education.

  The educational programs included at this level typically require the completion of nine years of full-time education since the beginning of level 1 with a theoretical duration of typically three years.

- Level 4. Post-secondary, non-tertiary education.

  These programs are often not significantly more advanced than programs at level 3 but they serve to broaden the knowledge of participants who have already completed a program at level 3. These programs typical duration is of at least three years

- Level 5. First stage of tertiary education.

  These programs last about four years, and lead to an award not equivalent to a first university degree.

- Level 6. Second stage of tertiary education.

  These programs last about three, four, or more years, and lead to a university or postgraduate university degree.

3.3.2.1.3 *Linking Skill Levels, Employment and Education*

According to the conceptual framework of the International Standard Classification of Occupations (ISCO), Skill levels are defined with reference to the different levels defined by the International Standard Classification of Education (ISCED).

- The first ISCO skill level was defined with reference to ISCED level 0.
- The second ISCO skill level was defined with reference to ISCED level 1.
- The third ISCO skill level was defined with reference to ISCED levels 2, 3 and 4.
- The fourth ISCO skill level was defined with reference to ISCED levels 5 and 6.

In summary, after observing ISCO and ISCED's classification of skills and educational levels, it is possible to suggest that:

- ISCO skill level 1 (elementary occupations) corresponds to ISCED level 0 (pre-primary education).
- ISCO skill levels 2 (plant and machine operators and assemblers, craft and related workers, skilled agricultural and fishery workers, service workers and shop and market sales workers) correspond to ISCED level 1 (primary education).
- ISCO skill level 3 (technicians and associate professionals) correspond to ISCED level 2, 3 and 4 (lower secondary education, upper secondary education and post-secondary, non-tertiary education).
- ISCO skill level 4 (professionals) corresponds to ISCED levels 5 and 6 (first stage of tertiary education, and second stage of tertiary education).

With this information being made available, it is now possible to bridge the gap between wages by employment type (as classified by LABORSTA) and its corresponding level of education. These data may now be utilized when estimating rates of return to investments in education at the international level, utilizing comparable figures.

3.3.2.2 *National Expenditure per Student*

The annual national expenditure per student (i.e. cost of schooling) used for calculating social returns to investment in education was obtained from the World Bank's World Development Indicators (WDI). Since expenditure per student is estimated as percentage of Gross Domestic Product (GDP), every country's GDP for the years observed was also gathered from the World Bank's WDI. This study estimates international returns to education for countries with data available between 1997 and 2007.

3.3.2.3 *Pre- Versus Post-Tax Treatment of Earnings in the Estimation of Private and Social Returns*

When estimating social returns to investments in education, Psacharopoulos' (1981) statement that the post- versus pre-tax treatment of earnings does not make a big difference in a rate of return calculation is considered. This means that when estimating social and private returns to education, the same average income levels are applied to the estimation of both. The difference between social and private returns will rely upon the addition of cost of schooling to the estimation of social returns.

3.3.2.4 *Defining and Measuring Levels of Development*

The classification of the countries included in this study was based on the country classification by the World Bank. Countries were grouped by their level of development. The widespread agreement that income level is a relatively objective way

to measure development is used in this study. Consequently, the country levels of development utilized in this study are defined and measured by income level. The World Bank classifies economies according to 2006 Gross National Income (GNI) per capita in:

- Low Income ($905 or less)
- Lower Middle Income ($906 - $3,595)
- Upper Middle Income ($3,596 - $11,115)
- High Income ($11,116 or more)

3.4 THE PRELIMINARY STUDY

The purpose of this preliminary study is to establish the substitutability of the earnings function method for estimating returns to education by the short-cut method. This is of great importance when data are limited for the estimating of these returns; particularly prevalent in less developed countries. In addition to the substitutability of the earnings function method by the short-cut method, the purpose of this preliminary study is also to provide evidence to suggest that when data on specific observed years by educational level is not available, the international standard years per educational level established by the International Standard Classification of Education is entirely acceptable.

3.4.1 Estimating Private Returns to Education through the Earnings Function Method for Both, Observed Average Years per Educational Level per Country, and Standard Years per Educational Level per Country

Returns to investments in education were estimated for 28 countries through the earnings function method. See Appendix 3 for the results of the regression specifications for the 28 countries observed in this preliminary study. These specifications were applied to the estimation of private returns to education for 28 countries using the earnings function method.

See Table 3.4 for the results of the estimation of returns to education through the earnings function method using both, observed average years per educational level per country, and standard years per education level per country. The estimation of returns based on average years per educational level per country is more accurate, since it reflects the specific reality of every country. However, a highly significant correlation between the returns estimated through the earnings function method with standard and observed average years per level of education was observed ($F\ 1, 78) = 352.29$, $p < .001$. A linear correlation coefficient (r) of .90 suggests a very strong positive relationship between the models. Also, it is possible to explain 82% (Adj R^2) of the results of estimating returns to education through observed average years by estimating returns through the standard years per educational level. These analyses provide enough evidence to suggest that in the absence of observed years per educational level per country, the use of standard years per education level when estimating returns to education through the earnings function method is completely adequate.

Table 3.4 Private Returns to Education Estimated through the Earnings Function Method with Observed Average Years per Educational Level and Standard Years per Level.

	Private Rates of Return (Earnings Function Method)					
	Observed average years per level			Standard years per level		
Country	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
Australia	0.011	0.051	0.043	0.018	0.029	0.038
	(0.013)	*(0.007)*	*(0.010)*	*(0.021)*	*(0.004)*	*(0.009)*
West Germany	0.005	0.033	0.046	0.007	0.021	0.059
	(0.010)	*(0.006)*	*(0.006)*	*(0.016)*	*(0.004)*	*(0.008)*
Great Britain	…	0.107	…	…	0.049	…
		(0.007)			*(0.003)*	
United States	0.002	0.114	0.096	0.002	0.059	0.099
	(0.022)	*(0.026)*	*(0.016)*	*(0.035)*	*(0.014)*	*(0.016)*
Austria	-0.030	0.059	0.045	-0.047	0.033	0.057
	(0.044)	*(0.009)*	*(0.011)*	*(0.069)*	*(0.005)*	*(0.014)*
Hungary	0.012	0.104	0.088	0.020	0.058	0.091
	(0.024)	*(0.010)*	*(0.014)*	*(0.038)*	*(0.005)*	*(0.014)*
Netherlands	0.004	0.036	0.034	0.006	0.023	0.041
	(0.010)	*(0.007)*	*(0.005)*	*(0.016)*	*(0.004)*	*(0.006)*
Italy	0.020	0.063	0.057	0.029	0.044	0.074
	(0.006)	*(0.007)*	*(0.007)*	*(0.009)*	*(0.005)*	*(0.010)*
Ireland	0.098	0.077	0.138	0.150	0.051	0.131
	(0.061)	*(0.010)*	*(0.012)*	*(0.093)*	*(0.006)*	*(0.011)*
Norway	0.005	0.021	0.013	0.007	0.012	0.013
	(0.009)	*(0.005)*	*(0.004)*	*(0.015)*	*(0.003)*	*(0.004)*
Switzerland	0.023	0.097	0.026	0.035	0.067	0.035
	(0.026)	*(0.015)*	*(0.018)*	*(0.040)*	*(0.010)*	*(0.025)*
Slovenia	0.002	0.127	0.105	0.004	0.067	0.101
	(0.009)	*(0.010)*	*(0.016)*	*(0.015)*	*(0.005)*	*(0.015)*
Sweden	0.011	0.035	0.012	0.018	0.020	0.012
	(0.008)	*(0.008)*	*(0.009)*	*(0.013)*	*(0.004)*	*(0.009)*
Czech Rep	0.027	0.027	0.031	0.046	0.012	0.038
	(0.008)	*(0.014)*	*(0.009)*	*(0.013)*	*(0.006)*	*(0.011)*
Poland	-0.005	0.106	0.117	-0.007	0.058	0.125
	(0.013)	*(0.007)*	*(0.010)*	*(0.020)*	*(0.004)*	*(0.011)*
New Zealand	-0.006	0.035	0.017	-0.010	0.017	0.019
	(0.010)	*(0.013)*	*(0.008)*	*(0.018)*	*(0.006)*	*(0.009*
Bulgaria	-0.054	0.055	0.059	-0.089	0.028	0.060
	(0.045)	*(0.016)*	*(0.015)*	*(0.074)*	*(0.008)*	*(0.016)*

Table 3.4 continued

	Observed average years per level			Standard years per level		
Country	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
Russia	-0.009	0.038	0.081	-0.016	0.025	0.065
	(0.010)	*(0.007)*	*(0.009)*	*(0.017)*	*(0.006)*	*(0.007)*
Canada	0.0005	0.033	0.046	0.001	0.022	0.053
	(0.016)	*(0.028)*	*(0.012)*	*(0.025)*	*(0.019)*	*(0.013)*
Czechoslovakia	-0.062	0.022	0.033	-0.102	0.010	0.042
	(0.044)	*(0.018)*	*(0.011)*	*(0.072)*	*(0.009)*	*(0.014)*
Philippines	0.026	0.206	0.276	0.038	0.171	0.239
	(0.025)	*(0.034)*	*(0.083)*	*(0.035)*	*(0.029)*	*(0.072)*
Israel	-0.025	0.041	0.084	-0.041	0.021	0.092
	(0.019)	*(0.019)*	*(0.012)*	*(0.031)*	*(0.010)*	*(0.013)*
Japan	0.014	0.151	0.073	0.022	0.082	0.072
	(0.009)	*(0.017)*	*(0.011)*	*(0.014)*	*(0.009)*	*(0.011)*
Spain	0.019	0.048	0.074	0.027	0.038	0.098
	(0.013)	*(0.018)*	*(0.017)*	*(0.019)*	*(0.014)*	*(0.022)*
Latvia	0.095	0.054	0.067	0.161	0.029	0.061
	(0.017)	*(0.029)*	*(0.029)*	*(0.028)*	*(0.016)*	*(0.026)*
Slovak Rep	-0.088	0.053	0.058	-0.150	0.021	0.074
	(0.006)	*(0.015)*	*(0.010)*	*(0.010)*	*(0.006)*	*(0.013)*
East Germany	-0.021	0.027	0.025	-0.032	0.017	0.023
	(0.003)	*(0.007)*	*(0.010)*	*(0.005)*	*(0.004)*	*(0.009)*
N Ireland	…	0.130	…	…	0.055	…
		(0.013)			*(0.006)*	

Regression specification includes controls for gender, public and union employment, marital status and year.
Estimates are returns on average income from 1985-1995.
Data Source: International Social Survey Program. Trostel, Walker and Woolley (2002).
Standard Errors in parenthesis.

3.4.2 Estimating Private Returns to Education through the Short-Cut Method for Both, Observed Average Years per Educational Level per Country, and Standard Years per Educational Level per Country

Returns to investments in education were estimated for 28 countries through the short-cut method using both, observed average years per educational level per country,

and standard years per education level per country (see Table 3.5). When estimating returns to education through the short-cut method using both, observed average years per educational level per country and standard years, a significant correlation was observed between the results (F 1, 78) = 313.24, $p < .001$. A linear correlation coefficient (*r*) of .89 suggests a very strong positive relationship between the models. Also, 80% (Adj R^2) of the results of estimating returns to education through observed average years may be explained by estimating returns through the standard years of educational level.

Table 3.5 Private Returns to Education Estimated through the Short-Cut Method with Observed Average Years per Educational Level and Standard Years per Level.

	Private Rates of Return (Short-Cut Method)					
	Observed average years per level			Standard years per level		
Country	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
Australia	-0.036	0.038	-0.005	-0.080	0.022	-0.003
West Germany	-0.029	0.029	0.044	-0.054	0.019	0.045
Great Britain	…	0.122	…	…	0.122	
United States	-0.0003	0.056	0.099	-0.001	0.029	0.081
Austria	-0.071	0.027	0.099	-0.148	0.015	0.101
Hungary	0.041	0.135	0.106	0.082	0.075	0.088
Netherlands	0.039	0.015	0.006	0.075	0.010	0.007
Italy	-0.013	0.070	0.128	-0.017	0.049	0.133
Ireland	0.066	0.075	0.209	0.179	0.049	0.158
Norway	0.012	-0.004	0.006	0.039	-0.002	0.005
Switzerland	0.034	0.089	0.026	0.068	0.062	0.028
Slovenia	0.019	0.128	0.165	0.036	0.067	0.128
Sweden	0.019	0.030	0.013	0.042	0.017	0.010
Czech Rep	0.029	0.011	0.036	0.078	0.004	0.034

Table 3.5 continued

	Observed average years per level			Standard years per level		
Country	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
Poland	0.0003	0.131	0.190	0.0005	0.072	0.162
New Zealand	-0.025	0.005	-0.036	-0.060	0.002	-0.032
Bulgaria	-0.110	0.041	0.072	-0.260	0.021	0.059
Russia	0.157	0.016	-0.127	0.292	0.010	-0.081
Canada	0.038	-0.006	0.058	0.073	-0.004	0.053
Czechoslovakia	-0.118	0.026	0.033	-0.192	0.012	0.034
Philippines	0.037	0.166	0.611	0.062	0.137	0.423
Israel	-0.002	0.020	0.102	-0.005	0.010	0.089
Japan	0.150	0.126	0.087	0.201	0.068	0.069
Spain	0.036	0.041	0.039	0.073	0.033	0.041
Latvia	0.555	0.071	0.072	0.957	0.038	0.053
Slovak Rep	-0.104	0.048	0.066	-0.182	0.019	0.069
East Germany	0.038	0.058	0.016	0.067	0.036	0.012
N Ireland	…	0.125	…	…	0.125	…

Estimates are returns on average income from 1985-1995.
Data Source: International Social Survey Program. Trostel, Walker and Woolley (2002).

Based on the previous analyses, it is safe to assume that estimating returns to education by using observed average years per educational level provides a more accurate estimation of these returns for the country being observed at the particular moment in time. Nevertheless, it is also acceptable to suggest that, when data on average years per educational level observed are not accessible, estimating returns to education through the standard years per educational level is entirely appropriate. This suggestion can be made when estimating returns to education through both, the earnings function and the short-cut methods.

3.4.3 Substituting the Earnings Function Method for Estimating Returns to Education by the Short-Cut Method

After estimating private returns to education through both, the earnings function and the short-cut methods, a significant positive correlation was found between the two sets of results. The estimation through the earnings function method was conducted using the strongest possible regression specification; controlling for gender, type of employment, marital status and year. This was conducted with the purpose of establishing the fact that when the strongest possible specification was applied, the results were correlated with the results estimated using the short-cut method. Additionally, and for comparison purposes between the methods, the returns estimated through the earnings function method were generated by using the observed average years per educational level per country per year, and the short-cut estimates were generated using standard years per educational level. This was conducted with the purpose of adding a greater level of rigor to this comparison and substitution. When this specification was added to the estimation, it was found that the methods were still substitutable.

The results suggested that there is a significant correlation between the returns to an additional level or schooling estimated through the earnings function and the short-cut methods ($F\ 1,\ 78) = 27.86$, $p < .001$. A linear correlation coefficient (r) of .51 suggests a strong positive relationship between the models. Also, it is possible to explain 25% (Adj. R^2) of the results of the earnings function method can be explained by the

short-cut method. Figure 3.1 represents the fit-line between the results yielded by the earnings function and short-cut methods.

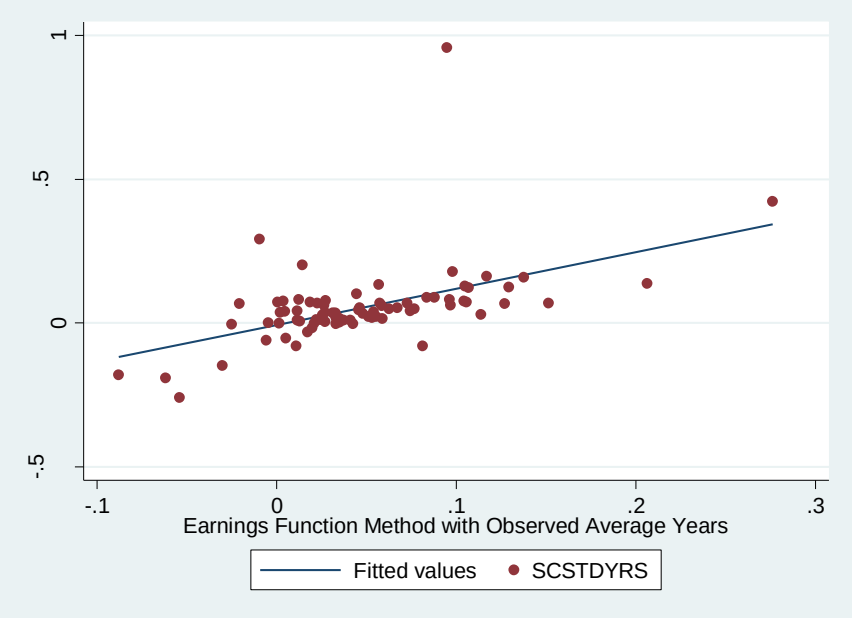

Figure 3.1 Regression Fit Line between the Results Yielded by Rates of Return to Education Estimated through the Earnings Function and Short-Cut Methods.

3.4.3.1 *Correlation between Returns to Education Estimated through Both the Earnings Function and the Short-Cut Methods by Educational Level*

The correlation between the earnings function and short-cut methods was also measured by educational level. These observations show an even higher relationship between the results yielded by the methods than when observing the results by returns to an additional level of education only.

At the primary level, the data show a significant correlation between the returns estimated by the earnings function and short-cut methods $F(1, 24) = 26.73$, $p < .001$. The relationship between the results was observed to be very strong ($r = .73$), and it was suggested that 51% (Adj. R^2) of the results of the earnings function method can be explained by the short-cut method. It is important to establish that in the majority of the countries observed, primary education is essentially universal, making the data on returns to primary education insignificant. In these cases, given the observed average years per educational level in the estimation of returns through the earnings function method, the results are the returns to an incomplete secondary level of education. However, this fact does not underestimate the validity of the substitutability of the results obtained by both methods.

At the secondary level, a significant correlation was also found between the returns estimated by both methods $F(1, 26) = 76.37$, $p < .001$. The relationship between the methods was also found to be very strong ($r = .86$), and it was suggested that 74% (Adj. R^2) of the results of the earnings function method can be explained by the short-cut method. Also, at the tertiary level of education, a significant correlation was found between the methods $F(1, 24) = 77.23$, $p < .001$. The relationship between the results yielded by both methods is very strong ($r = .87$), and it was suggested that 75% (Adj. R^2) of the results of the earnings function method can be explained by the short-cut method.

3.4.3.2 *Biases in the Directionality of the Estimates of Returns to Education through the Earnings Function and Short-Cut Methods*

When interpreting results of returns obtained through the short-cut method, it is important to emphasize the existence of biases in the directionality of the estimations. This is fundamental for the interpretation of these estimates. For instance, returns to primary education estimated through the short-cut method tend to be upward biased when compared with the same returns estimated through the earnings function method. On the contrary, the returns to secondary education tend to be underestimated by short-cut method. And lastly, the directionality of the returns to tertiary education estimated through the short-cut method, in relation to the earnings function method is inconclusive.

Despite the limitations of substituting the earnings function method by the short-cut method, this analysis provides evidence to suggest it to be an acceptable alternative for the estimation of returns to education at the international level. This is particularly true and necessary when attempting to estimate these estimates for countries with limited data availability. This validates the appropriateness of the substitution of the earnings function method by the short-cut method.

3.4.4 Negative Returns to Investments in Education

The results of this preliminary study yielded a number of surprisingly low and negative returns to education. This fact, though unforeseen, is certainly not unprecedented. Abundant literature addresses the issue of negative returns to education, particularly when observing returns to education in developed countries; comparable

with the countries observed in this study. Returns to education are affected by the impact of undereducation and overeducation on wages. Overeducation and undereducation are observed when workers' levels of education are higher or lower than is required for the job they perform (Galasi, 2004).

In the last 20 to 40 years, the proportion of graduates in the work force has risen dramatically, resulting in a labor force with more education than is required for their jobs. This issue is particularly predominant in developed nations where returns to education are observed to fall as the educated population rises (Chevalier, 2003; Daly, Büchel, & Duncan, 2000; Dolton & Vignoles, 2000; Hartog, 2000; Moffitt, 2007). Generally speaking, returns to surplus education are smaller than the returns to required education. In developed countries, overeducation is associated with a pay penalty of 5%-26% (Chevalier, 2003; Cohn & Khan, 1995; Cohn & Ng, 2000; Dolton & Vignoles, 2000; Galasi, 2004).

Overeducation and undereducation are suggested to be the result of changes in supply and demand through time. In the United States, for example, an excess supply of graduates, resulted in the fall of the returns to an academic degree in the 1970s (Freeman, 1976). Moreover, in the UK, it is believed that the large intake of students that took place since the mid-1980s, in addition to a reduction in the cost per student, resulted in lower returns to education (Chevalier, 2003). Additionally, Hungary (which should be observed in the context of a transitional economy) experienced a large-scale job losses and a small number of new jobs from the second half of the 1980s to the mid-1990s. But by the end of the 1990s, workplaces with a demand for educated workers appeared,

increasing the returns to investments in education to young and educated workers. However, by the beginning of the 21st century, the proportion of individuals with higher levels of education increased disproportionally, resulting in the wage returns to education falling again (Galasi, 2004).

Currently, it is possible that across industrial countries, and as a result of the existing international financial crisis, an oversupply of graduates is beginning to re-appear and we might be in the initial stages of a period in which returns to education are beginning to fall again (Dutta, Sefton, & Weale, 1999). According to the history of industrial economies of the last 40 years, during periods of transition, the education supply and demand pattern is characterized by a tendency to undereducation at the beginning of the transition, followed by a tendency to overeducation at the end of such transition (Galasi, 2004).

Contrary to the idea that overeducation is the result of disequilibrium, is the notion that the effects of overeducation tend to be permanent. This is reflected by the fact that overeducated individuals tend to continue to be overeducated, even after years in the same type of employment. Overeducation is the result of misallocation and, consequently, a waste of resources; costly to both, society and individuals. The obvious solution to the issue of overeducation is the proper allocation of resources in education (Chevalier, 2003).

Another observed agent influencing returns to education in developed countries is the establishment of minimum wages. And although their effect is lesser than that of supply and demand, minimum wages are associated with declines in the returns to

education (Funkhouser, 1998). Stable economies with established minimum wages might reduce the perceived need for education, since wages are predetermined and not necessarily contingent on required levels of education. Hence, returns to investments in education decline. The case of negative returns to investments in education in Russia and other former communist nations might also be a reflection of the earlier governmental control and non-market compensation factors (Benitez-Silva & Sheidvasser, 2000).

Another feasible explanation for negative returns to education is that, in this case, the application of ordinary least square (OLS) regression analysis in their estimation might have a negative effect on the results. Returns to education estimated through OLS regression methods tend to be downward biased, often by sizeable amounts, when compared with returns estimated through alternative methods such as instrumental variables (IV) (Card, 2001; Harmon & Walker, 1995, 1999; Heckman, et al., 2006).

Finally, much of the literature on returns to investments in education "has relied on years of schooling to measure educational human capital. Yet what really matters is not how much time a person spends at school, but rather what academic standard they achieve (Dolton & Vignoles, 2000). Conventional wisdom, as well as an abundant body of literature, suggest that an additional year invested in education produces a positive return reflected on wages. However, when returns are estimated by educational level, there is a greater probability of stumbling upon the issue of overeducation in relationship to employment and, consequently, lower returns to education.

3.5 CONCLUSIONS AND FINAL REMARKS

On this section, the analytical techniques applied to the analyses conducted through this dissertation are presented. Also, the data utilized in the preliminary study suggesting the viability of the short-cut method in the estimation of returns to education are presented. The operationalization of the data is also explained. Additionally, the data utilized in the estimation of returns for 59 countries at different levels of economic development are also presented.

Through this section, the viability of the short-cut method for estimating returns to investments in education is suggested. The earnings function and short-cut methods based on the Mincerian equation for estimating returns to investments in education are certainly limited in terms of their methodological preciseness. However, when estimates of returns to education are challenged by the limitation of data availability prevalent in less developed countries, the Mincerian model provides a sensible methodology which can be used in the estimation of returns to investments in education in regions of the world characterized by their limitations on data availability.

The two methodologies most commonly applied to the estimation of returns to education, based on the Mincerian model, are the earnings function and the short-cut methods. The earnings function method is a more data-rich, sound methodology for the estimation of rates of returns to education. However, when challenged by the limited data prevalent in less-developed countries, the short-cut method, a more parsimonious methodology, has been suggested to be a reliable substitute for the earnings function method. Through this preliminary study it may be suggested that there is a highly

significant correlation between returns estimated through the earnings function method and the short-cut method. Moreover, when estimates of returns to education are observed by educational level (primary, secondary and tertiary), the correlation between the results yielded by both methods is even higher.

4. DATA ANALYSIS

4.1 INTRODUCTION

On the previous section, it was suggested that the short-cut method for estimating rates of return to investments in education is a valuable tool for the estimation of these returns, particularly true for low-income economies; countries with limited data for the establishment of sound policies regarding the efficient allocation to limited resources to education.

On this section, the estimates of returns to different levels of education for countries at different levels of economic development are presented. The analyses of the results are classified as follows:

- International comparisons of private returns to overall investments in education by country level of economic development
- Private returns to education in low, low-middle, high-middle and high income economies by level of education
- Comparisons of international average private returns to education by level of education
- Private returns to investments in primary, secondary and tertiary education by country level of economic development

As stated earlier in this dissertation, there are two main issues concerning estimates of returns to investments in education at the international level. First is the fact

that in most cases, returns for different countries are usually estimated through a wide variety of different methodologies. The second issue is that returns are generated using data which are either incomplete or not comparable[3]. The issue of multiple methodologies has been addressed through the establishment of the fact that the short-cut variation of the Mincerian equation is perfectly fit for the purposes of estimating returns to education at the international level, especially for countries with limited data availability. The issue of incomplete and non comparable data is addressed through the use of comparable data compiled by a single source; the International Labor Organization.

4.2 THE RESULTS

Private and social rates of return to investments in education were estimated for primary, secondary, and tertiary education. The results were estimated through the Mincerian short-cut method for low, low-middle, high-middle and high income economies. Data were gathered from 1997 to 2007 through LABORSTA and the World Bank World Development Indicators. Tables 4.1, 4.2, 4.3 and 4.4 represent private and social returns to investments in education for low, low-middle, high-middle and high income economies respectively. The section 4.3 presents an analysis of the data.

[3] In an attempt to observe the effects of different data sets on the estimation of returns to education with a single methodology, returns to education estimated with data from ISSP and ILO, both estimated through the short-cut method were compared. A linear correlation coefficient (r) of 0.11 suggests a weak relationship between the models. Also only 2% (R^2) of the results of estimating returns to education through the short-cut method using ISSP data can be explained by estimating the same returns with data from ILO. However, it is important to establish that only 5 countries with sufficient data availability were found in both, ISSP and ILO datasets.

Table 4.1 Private and Social Rates of Return to Investments in Education for Low Income Economies.

RATES OF RETURN TO INVESTMENTS IN EDUCATION						
LOW INCOME ECONOMIES						
	Private Returns to Education			Social Returns to Education		
Country	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
Bangladesh	0.0904	-0.0208	0.1007	0.0495	-0.0126	0.0312
Burkina Faso	0.0726	0.0451	0.2237	0.0246	0.0214	0.0222
C. African Republic	0.1079	0.1480	0.2067	0.0790	…	0.0317
Chad	0.1966	0.0377	0.4245	0.1509	0.0240	0.0597
Comoros	0.0910	0.0238	0.0423	0.0686	0.0238	0.0423
Cote D'Ivoire	0.0349	0.0543	0.1674	0.0170	0.0154	0.0187
Eritrea	0.0694	0.1228	0.0908	0.0538	0.0838	0.0117
Ethiopia	0.2004	0.0356	0.0782	0.1053	0.0265	0.0038
India	0.3301	0.1984	6.6274	0.1399	0.1086	2.8218
Kyrgyzstan	0.1532	-0.0032	-0.0127	…	…	-0.0071
Malawi	0.0423	0.1197	0.2283	0.0405	0.1111	…
Myanmar	0.0946	0.0219	0.1366	…	…	…
Nigeria	0.0233	0.0178	0.3138	…	…	…
Pakistan	0.0888	0.0524	0.0703	…	…	…
Sudan	-0.1372	0.1666	0.2985	…	…	…
Togo	0.0658	0.1522	0.2999	0.0577	0.1209	0.1648
Zambia	-0.0049	0.0910	0.2435	-0.0047	0.0831	0.1403
Zimbabwe	0.0092	0.0171	…	0.0091	0.0166	…

Table 4.2 Private and Social Rates of Return to Investments in Education for Low-Middle Income Economies.

RATES OF RETURN TO INVESTMENTS IN EDUCATION						
LOW-MIDDLE INCOME ECONOMIES						
	Private Returns to Education			Social Returns to Education		
Country	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
Algeria	0.0325	-0.0271	0.0790	0.0303	-0.0246	…
Angola	0.0183	0.0393	0.0299	0.0183	0.0393	0.0299
Azerbaijan	0.0096	0.0562	-0.0073	0.0096	0.0562	-0.0073
Belarus	0.0524	-0.0350	0.0125	…	…	0.0112
Bolivia	0.0227	0.0936	0.0478	0.0157	0.0697	0.0284

Table 4.2 Continued.

	Private Returns to Education			Social Returns to Education		
Country	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
China	0.0145	0.0457	0.0564	…	0.0239	0.0086
Dominican Rep.	0.1199	-0.1050	0.1267	0.0751	-0.0868	…
Egypt	-0.0054	0.0563	0.0141	…	…	…
El Salvador	0.1392	0.0514	0.2334	0.0371	0.0204	0.0887
Honduras	0.1157	0.0320	0.1665	…	…	…
Indonesia	0.0966	0.0280	0.0928	…	…	…
Moldova	0.0537	-0.0117	0.0421	0.0204	-0.0047	0.0164
Namibia	0.3958	0.0346	0.1640	0.2745	0.0294	0.0990
Nicaragua	0.1089	0.0328	0.1049	0.0734	0.0291	…
Peru	0.0385	0.1551	0.1217	0.0267	0.1051	0.0907
Sri Lanka	0.0734	0.0438	0.1960	…	…	…
Suriname	0.0887	0.0006	0.0480	…	…	…
Thailand	0.0546	0.1522	0.1551	0.0210	0.0813	0.0693
Tunisia	0.0150	0.0624	0.1196	0.0073	0.0263	0.0320
Ukraine	-0.0393	0.1225	-0.0077	-0.0114	0.0211	-0.0012

Table 4.3 Private and Social Rates of Return to Investments in Education for High-Middle Income Economies.

RATES OF RETURN TO INVESTMENTS IN EDUCATION						
HIGH-MIDDLE INCOME ECONOMIES						
	Private Returns to Education			Social Returns to Education		
Country	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
Argentina	0.0664	0.1353	-0.0341	0.0361	0.0727	-0.0242
Bulgaria	0.0487	0.0015	0.1003	0.0001	0.00001	0.0002
Costa Rica	0.0420	0.0536	0.1353	0.0296	0.0373	0.0761
Hungary	0.0400	0.0271	0.1590	0.0073	0.0058	0.0302
Kazakhstan	0.0787	0.0455	0.0319	…	…	0.0239
Lithuania	0.0472	0.0127	0.0925	0.0107	0.0028	0.0212
Romania	0.0608	0.0453	0.1295	0.0607	0.0453	0.1294
Russian Federation	0.0734	0.0194	0.0752	…	…	0.0322
Slovakia	0.0451	0.0260	0.0869	0.0417	0.0239	0.0769

Table 4.4 Private and Social Rates of Return to Investments in Education for High Income Economies.

RATES OF RETURN TO INVESTMENTS IN EDUCATION						
HIGH INCOME ECONOMIES						
	Private Returns to Education			Social Returns to Education		
Country	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
Bahrain	0.1047	0.0393	0.1339	0.0198	0.0100	…
Bermuda	0.0371	-0.0075	0.0698	0.0001	-0.00002	…
Finland	0.0132	0.0141	0.0572	0.0065	0.0056	0.0205
Italy	0.0224	0.0288	0.1021	0.0223	0.0286	0.1016
Korea, Republic of	0.0201	0.0379	0.0764	0.0049	0.0086	0.0370
Kuwait	0.1388	0.1233	0.1010	0.0202	0.0248	0.0066
Luxembourg	0.0291	0.0550	0.1025	0.0044	0.0086	…
Portugal	0.0179	0.0754	0.1428	0.0166	0.0686	0.1351
Puerto Rico	0.0390	0.0175	0.2021	…	…	…
San Marino	0.0191	-0.0005	0.0580	…	…	…
Singapore	0.0800	0.0472	0.1953	…	…	…
United Kingdom	0.0397	-0.0008	0.1517	0.0031	-0.0001	0.0090

As it is to be expected, social returns to investments in education tend to be lower than private returns. This is essentially due to the fact that public expenditure in education is considered when estimating social returns.

It is important to establish that when investments in education are minimal, the social returns might seem as high as private returns. These patterns must be analyzed on a country-by-country basis in order to clearly observe their policies on investments in education before arriving to any conclusions regarding their social returns to education. For instance, seemingly high social returns might be the result of low expenditures in education per pupil at a particular educational level.

Also, it is important to emphasize that the estimated returns to different levels of education for countries at different levels of economic development presented outliers

for returns to tertiary education in India and returns to primary education in Namibia. In order to adjust for measurement errors, values three standard deviations above and below the mean of returns to education were removed from the data prior to analyzing the differences among these returns.

4.3 THE ANALYSIS

4.3.1 International Comparisons of Private Returns to Overall Investments in Education by Country Level of Economic Development

A statistically significant difference among international average private returns to overall investments in education in countries at different levels of economic development between 1997 and 2007 was found. Low income economies, with an average 11.0%, have the highest average returns to investments in education. Low-middle income economies are observed to gain an average of 6.2% return to investments in education, high-middle income economies a 6.1%, and high income economies display a 6.6% average return to investments in education. See Table 4.5 for summary statistics of international private returns to overall investments in education for countries at different levels of economic development between 1997 and 2007.

Table 4.5 Summary Statistics of International Private Returns to Overall Investments in Education for Countries at Different Levels of Economic Development between 1997 and 2007.

Level of Development	International Returns to Education		
	Mean	Std. Dev.	Freq.
Low Income	.110025	.10534263	52
Low-Middle Income	.06157797	.06327608	59
High-Middle Income	.06093333	.04431067	27
High Income	.06621111	.05482508	36
Total	.07691494	.0773974	174

Also, see Figure 4.1 for a graphic representation of international average private returns to overall investments in education for countries at different levels of economic development between 1997 and 2007.

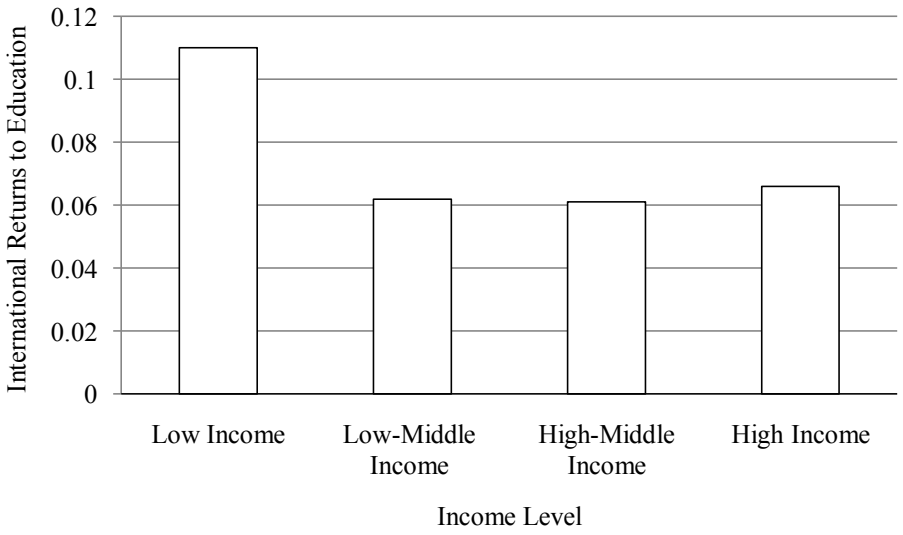

Figure 4.1 International Average Private Returns to Overall Investments in Education for Countries at Different Levels of Economic Development between 1997 and 2007.

Differences in returns to overall investments in education for countries at different levels of development between 1997 and 2007 are found to be statistically significant F (3, 170) = 4.86, $p < .01$. See Table 4.6 for an Analysis of Variance table suggesting the statistically significant differences among international returns to education for countries at different levels of economic development between 1997 and 2007.

Table 4.6 Analysis of Variance Suggesting the Statistically Significant Difference among International Returns to Education for Countries at Different Levels of Economic Development between 1997 and 2007.

Analysis of Variance					
Source	SS	df	MS	F	Prob > F
Between groups	.081905207	3	.027301736	4.86	0.0029
Within groups	.954426528	170	.005614274		
Total	1.03633174	173	.005990357		

Once it was established that there is a significant difference among international returns to education in countries at different levels of economic development between 1997 and 2007, Bonferroni multiple-comparisons procedure was applied with the purpose of comparing each pair of means and determine the significance of the differences among the observed returns. Through the application of the multiple-comparisons procedure, it was suggested that the differences in overall returns to education for countries at different levels of economic development are significant only between low income and low-middle income economies, between low income and high-

middle income economies, and between low income and high income economies. See Table 4.7 for the results of multiple-comparisons procedure applied to the differences among average private returns to education for countries at different levels of economic development between 1997 and 2007.

Table 4.7 Results of Bonferroni's Multiple-Comparisons Procedure Applied to the Observed Differences among Average Private Returns to Education for Countries at Different Levels of Economic Development between 1997 and 2007.

Comparison of International Returns to Education
by Level of Development
(Bonferroni)

Row Mean- Col Mean	Low	Low-Middle	High-Middle
Low-Middle Income	-.048447 0.005		
High-Middle Income	-.049092 0.038	-.000645 1.000	
High Income	-.043814 0.046	.004633 1.000	.005278 1.000

For additional clarity in the understanding of the differences among these groups, Figure 4.2 provides a sense of the variability of international average returns to education within groups of countries at different levels of development between 1997 and 2007.

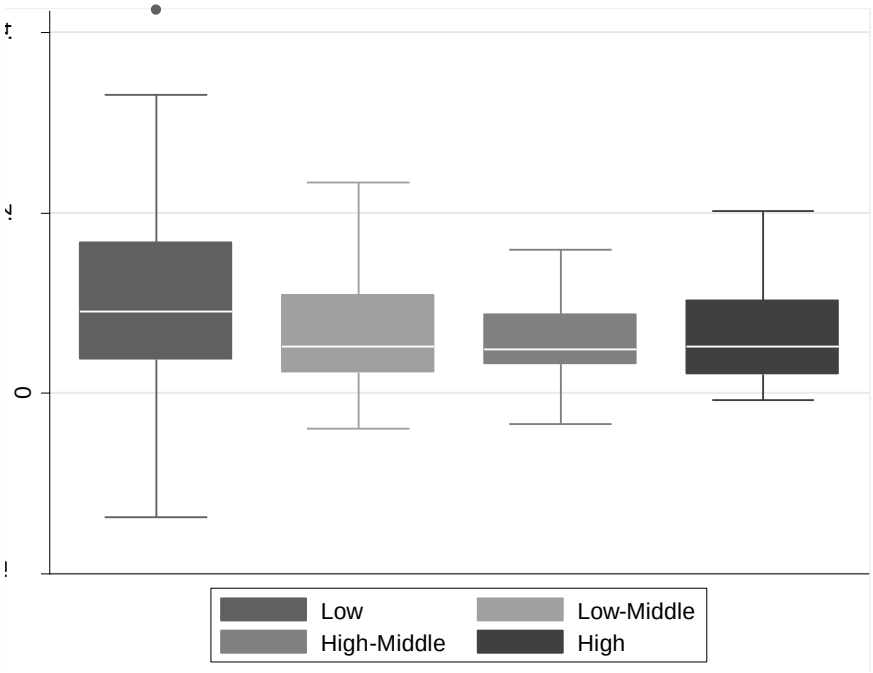

Figure 4.2 International Average Private Returns to Education for Countries at Different Levels of Development Providing a Sense of the Variability of International Returns to Education within Groups of Countries at Different Levels of Development between 1997 and 2007.

4.3.2 Private Returns to Education in Low, Low-Middle, High-Middle and High Income Economies by Level of Education

The following section presents an analysis of the returns to education in low, low-middle, high-middle and high income economies by educational level.

4.3.2.1 *Private Returns to Investments in Education for Low Income Economies by Educational Level*

Low income economies have been found to have the highest average private returns to education at the tertiary level. The return to tertiary education for low income economies is 18.2%, whereas returns to primary are 8.5% and secondary are 7.1%. See Table 4.8 for summary statistics of average private returns to investments in education for low income economies by level of education between 1997 and 2007.

Table 4.8 Summary Statistics of Average Private Returns to Investments in Education for Low Income Economies by Level of Education between 1997 and 2007.

	Returns to Low Income Economies		
Educational Level	Mean	Std. Dev.	Freq.
Primary	.08491111	.09800943	18
Secondary	.07113333	.06476739	18
Tertiary	.18203125	.11826581	16
Total	.110025	.10534263	52

Also, see Figure 4.3 for a graphic representation of average private returns to education for low income economies by level of education between 1997 and 2007.

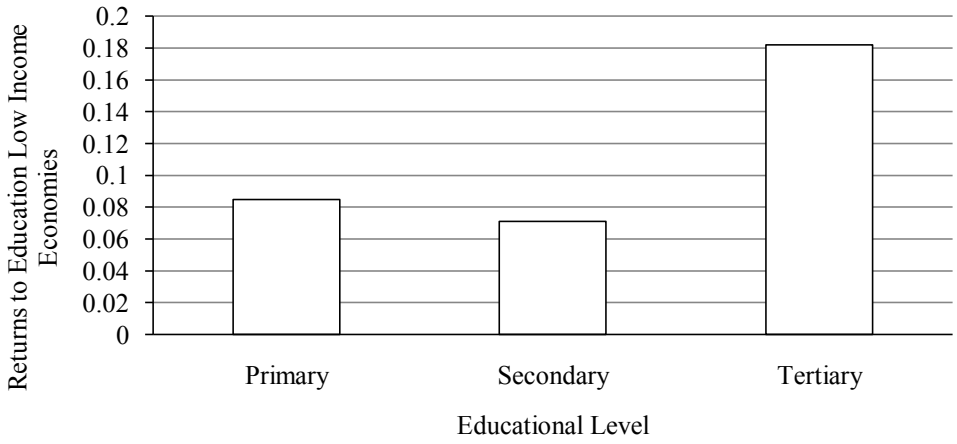

Figure 4.3 Average Private Returns to Education for Low Income Economies by Educational Level between 1997 and 2007.

Average private returns to education to primary, secondary and tertiary education for low income economies between 1997 and 2007 have been found to be significantly different F (2, 49) = 6.70, $p < .01$. See table 4.9 for an Analysis of Variance table suggesting the statistically significant differences among returns to primary, secondary and tertiary education for low income economies between 1997 and 2007.

Table 4.9 Analysis of Variance Suggesting the Statistically Significant Differences among Returns to Primary, Secondary and Tertiary Education for Low Income Economies between 1997 and 2007.

Analysis of Variance

Source	SS	df	MS	F	Prob > F
Between groups	.121537244	2	.060768622	6.70	0.0027
Within groups	.444413309	49	.009069659		
Total	.565950553	51	.01109707		

Once it was established that there is a significant difference among the returns, Bonferroni multiple-comparisons procedure was applied with the purpose of comparing each pair of means and determine the location of the differences among the observe returns. Through the application of the multiple-comparisons procedure, it was found that the differences in returns to education to for low income economies are significantly different between primary and tertiary education and also between secondary and tertiary education. See Table 4.10 for the results of multiple-comparisons procedure applied to the differences among average returns to primary secondary and tertiary education in low income economies between 1997 and 2007.

Table 4.10 Results of Bonferroni's Multiple-Comparisons Procedure Applied to the Observed Differences among Average Returns to Primary, Secondary and Tertiary Education for Low Income Economies between1997 and 2007.

Returns to Low Income Economies
by Educational Level
(Bonferroni)

Row Mean- Col Mean	Primary	Secondary
Secondary	-.013778 1.000	
Tertiary	.09712 0.014	.110898 0.004

For additional clarity in the understanding of the differences among these groups, Figure 4.4 provides a sense of the variability of the average returns to education within

groups representing different educational levels for low income economies between 1997 and 2007.

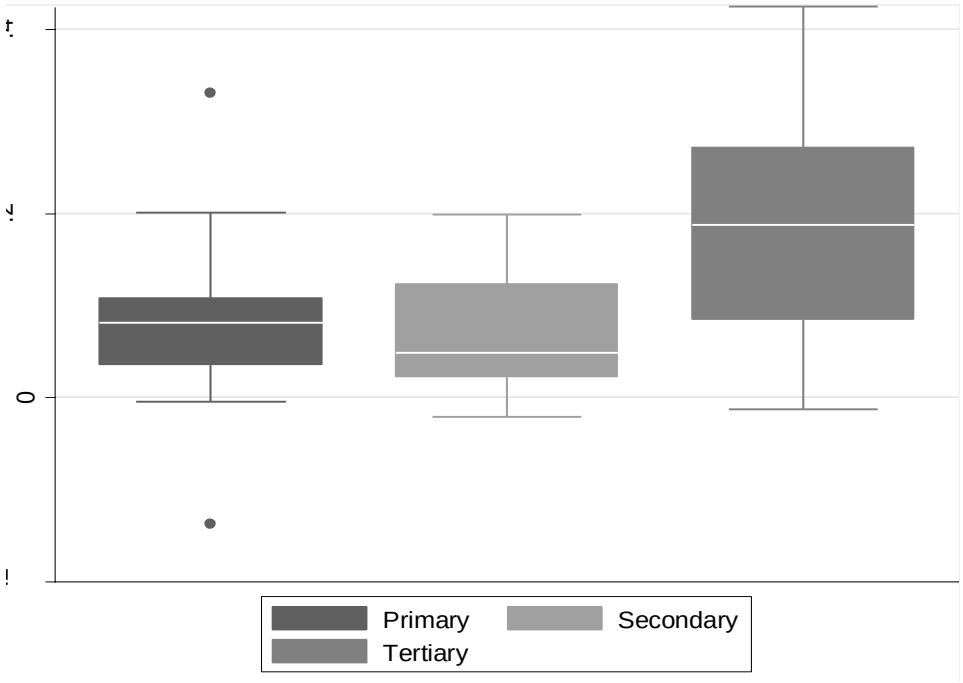

Figure 4.4 Average Private Returns to Education for Low Income Economies Showing the Variability of Returns to Education within Groups Representing Different Educational Levels between 1997 and 2007.

4.3.2.2 *Private Returns to Investments in Education for Low-Middle Income Economies by Educational Level*

Low-middle income economies have been observed to also have the highest average private returns to education at the tertiary level with an average of 9.0% followed by 5.3% in primary and 4.1% in secondary. See Table 4.11 for summary statistics of average private returns to investments in education at different educational levels for low-income economies between 1997 and 2007.

Table 4.11 Summary Statistics of Average Private Returns to Investments in Education at Different Educational Levels for Low-Middle Income Economies between 1997 and 2007.

Level of Education	Returns to Low-Middle Income Economies		
	Mean	Std. Dev.	Freq.
Primary	.05313158	.04833286	19
Secondary	.041385	.06170883	20
Tertiary	.089795	.06973204	20
Total	.06157797	.06327608	59

Also, See Figure 4.5 for a graphic representation of average private returns to education for low-middle income economies by level of education between1997 and 2007.

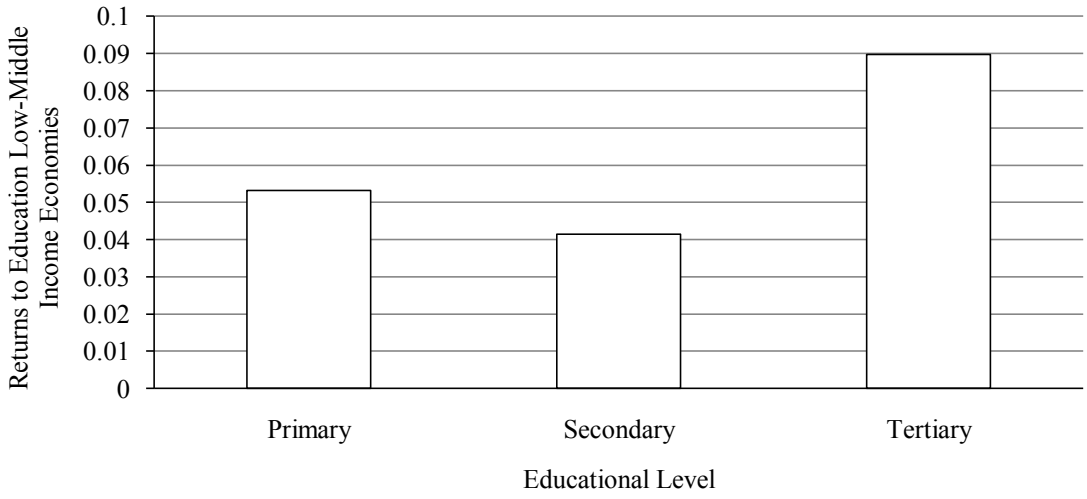

Figure 4.5 Average Private Returns to Education for Low-Middle Income Economies by Educational Level between 1997 and 2007.

Average returns to education for primary, secondary and tertiary education for low-middle income economies between 1997 and 2007 have been found to be significantly different F (2, 56) = 3.44, $p < .05$. See Table 4.12 for an Analysis of Variance table suggesting the statistically significant differences among average returns to primary, secondary and tertiary education for low-middle income economies between 1997 and 2007.

Table 4.12 Analysis of Variance Suggesting the Statistically Significant Differences among Average Returns to Primary, Secondary and Tertiary Education for Low-Middle Income Economies between 1997 and 2007.

Analysis of Variance

Source	SS	df	MS	F	Prob > F
Between groups	.025434626	2	.012717313	3.44	0.0389
Within groups	.206789398	56	.003692668		
Total	.232224024	58	.004003862		

Once it was established that there is a statistically significant difference among the returns, Bonferroni's multiple-comparisons procedure was applied with the purpose of comparing each pair of means and determine the location of the differences among the observed returns. Through the application of the multiple-comparisons procedure, it was found that the differences in average returns to returns to primary, secondary and tertiary education for low-middle income economies are only statistically significant between secondary and tertiary education. See Table 4.13 for the results of multiple-comparisons procedure applied to the differences among average returns to primary, secondary and tertiary education for low-middle income economies between 1997 and 2007.

Table 4.13 Results of Bonferroni's Multiple-Comparisons Procedure Applied to the Observed Differences among Average Returns to Primary, Secondary and Tertiary Education in Low-Middle Income Economies between 1997 and 2007.

Returns to Low-Middle Economies
by Level of Education
(Bonferroni)

Row Mean- Col Mean	Primary	Secondary
Secondary	-.011747 1.000	
Tertiary	.036663 0.195	.04841 0.044

For additional clarity in the understanding of the differences among these groups, Figure 4.6 provides a sense of the variability of average returns to education within groups representing different educational levels for low-income economies between 1997 and 2007.

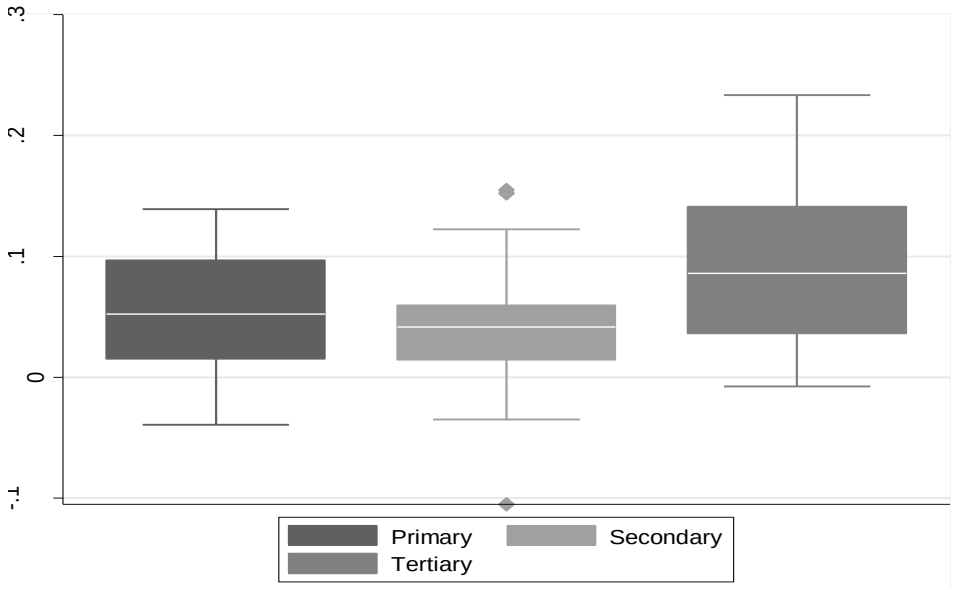

Figure 4.6 Average Returns to Education for Low-Middle Income Economies Showing the Variability of Returns to Education within Groups Representing Different Educational Levels for Low-Middle Income Economies between 1997 and 2007.

4.3.2.3 *Private Returns to Investments in Education for High-Middle Income Economies by Educational Level*

High-middle income economies also show the highest average private returns to tertiary education with an 8.6%, followed by primary with 5.6% and secondary with 4.1%. See Table 4.14 for summary statistics of average private returns to investments in education for primary, secondary and tertiary education in high-middle income economies between 1997 and 2007.

Table 4.14 Summary Statistics of Average Private Returns to Investments in Primary, Secondary and Tertiary Education in High-Middle Income Economies between 1997 and 2007.

Level of Education	Returns to High-Middle Income Economies		
	Mean	Std. Dev.	Freq.
Primary	.05581111	.01436345	9
Secondary	.04071111	.03926695	9
Tertiary	.08627778	.05848724	9
Total	.06093333	.04431067	2

Also, see Figure 4.7 for a graphic representation of average private returns to education for high-middle income economies by level of education between 1997 and 2007.

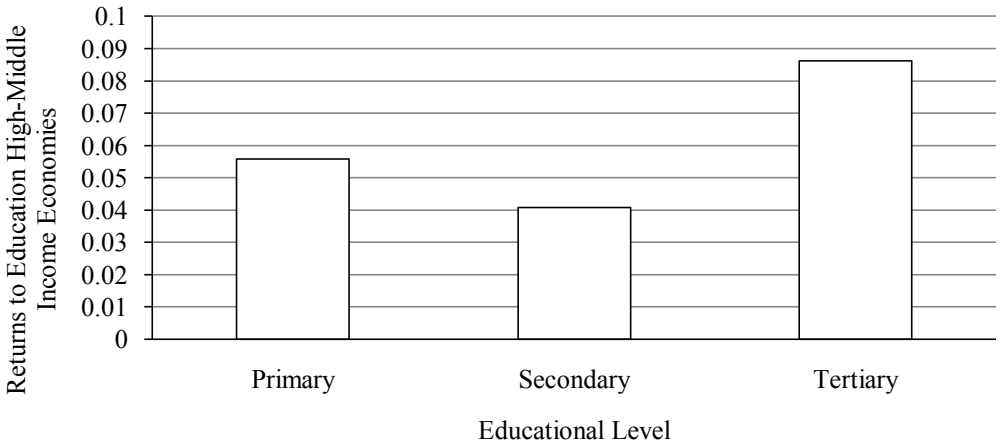

Figure 4.7 Average Private Returns to Education for High-Middle Income Economies by Educational Level between 1997 and 2007.

The differences observed among average returns to primary, secondary and tertiary education for high-middle income economies between 1997 and 2007 have not been found to be statistically significant. See Table 4.15 for an Analysis of Variances suggesting that the differences in returns to primary, secondary and tertiary education are not statistically significant for high-middle income economies between 1997 and 2007.

Table 4.15 Analysis of Variance Suggesting that the Differences in Average Returns to Primary, Secondary and Tertiary Education for High-Middle Income Economies Are Not Statistically Significant between 1997 and 2007.

Analysis of Variance

Source	SS	df	MS	F	Prob > F
Between groups	.009697647	2	.004848823	2.81	0.0798
Within groups	.041351671	24	.001722986		
Total	.051049318	26	.001963435		

Given the fact that the differences among returns to primary education in countries at different levels of development are not statistically significant, it will not be necessary to apply multiple-comparison procedures for this part of the analysis.

For additional clarity in the understanding of the non-significant differences among average returns to primary, secondary and tertiary education in high-middle income economies, Figure 4.8 provides a sense of the variability of returns to primary education within groups representing different educational levels between 1997 and 2007.

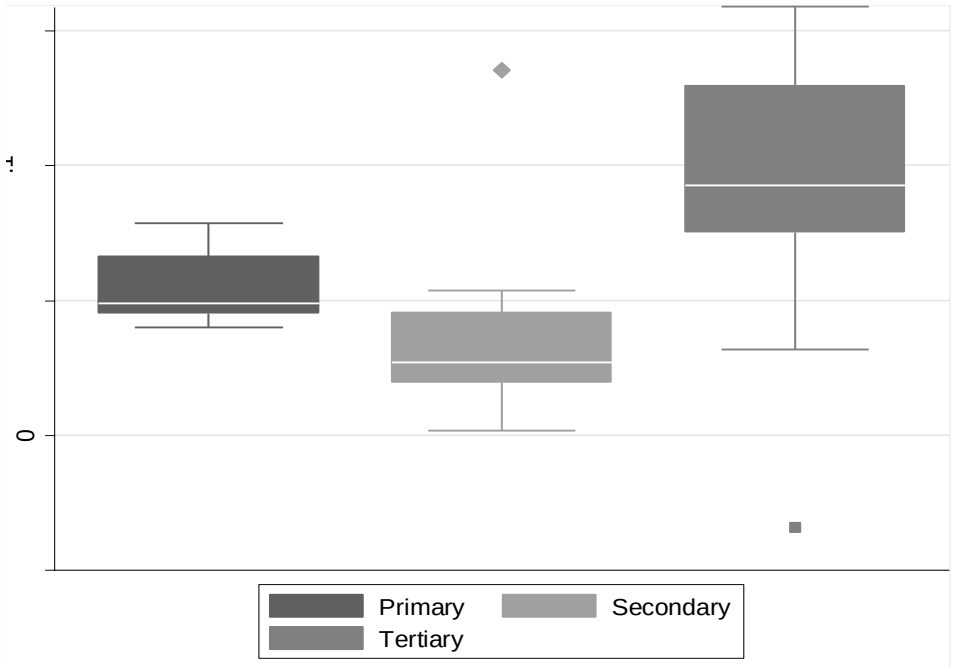

Figure 4.8 Average Private Returns to Primary, Secondary and Tertiary Education for High-Middle Income Economies Showing the Variability of Returns within Groups Representing the Different Educational Levels between 1997 and 2007.

4.3.2.4. *Private Returns to Investments in Education for High Income Economies by Educational Level*

The pattern for high income economies is consistent with the rest of the world. Private returns are higher for tertiary education with an 11.6%, followed by the returns to primary education with a 4.7% and by secondary education with a return of 3.6%. See Table 4.16 for summary statistics of average private returns to investments in primary, secondary and tertiary education for high income economies between 1997 and 2007.

Table 4.16 Summary Statistics for Average Private Returns to Primary, Secondary and Tertiary Education for High Income Economies between 1997 and 2007.

Level of Education	Returns to High Income Economies		
	Mean	Std. Dev.	Freq.
Primary	.04675833	.03985995	12
Secondary	.03580833	.03708294	12
Tertiary	.11606667	.049671	12
Total	.06621111	.05482508	36

Also, see Figure 4.9 for a graphic representation of average private returns to education for high income economies by level of education between 1997 and 2007.

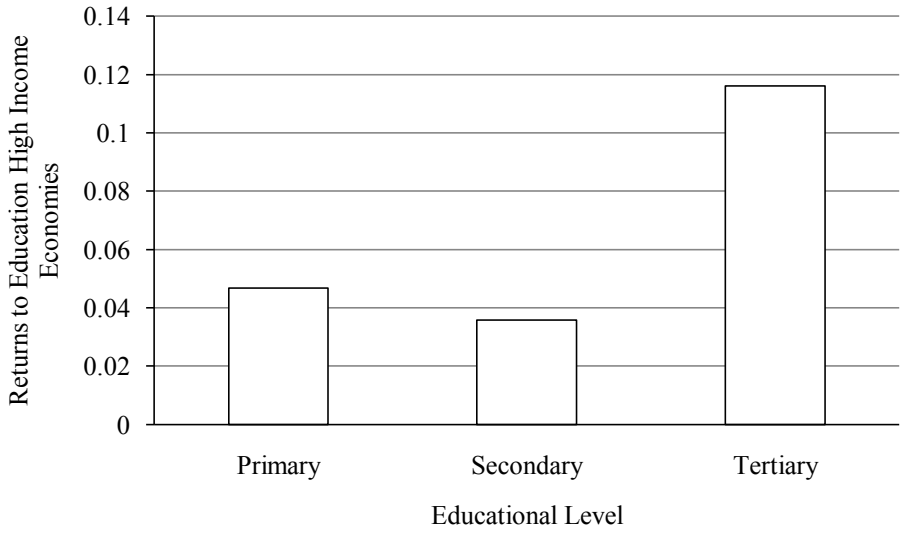

Figure 4.9 Average Private Returns to Education for High Income Economies by Educational Level between 1997 and 2007.

Private returns to primary, secondary and tertiary education for high income economies between 1997 and 2007 have been found to be significantly different F (2, 33) = 12.56, $p < .001$. See Table 4.17 for an Analysis of Variance table suggesting the statistically significant differences among returns to primary, secondary and tertiary education for high income economies between 1997 and 2007.

Table 4.17 Analysis of Variance Suggesting the Statistically Significant Differences among Average Returns to Primary, Secondary and Tertiary Education for High Income Economies between 1997 and 2007.

Analysis of Variance

Source	SS	df	MS	F	Prob > F
Between groups	.04545979	2	.022729895	12.56	0.0001
Within groups	.059742844	33	.001810389		
Total	.105202634	35	.00300579		

Once it was established that there is a significant difference among the returns, Bonferroni's multiple-comparisons procedure was applied with the purpose of comparing each pair of means and determine the location of the differences among the observed returns. Through the application of the multiple-comparisons procedure, it was found that the differences in returns to education for high income economies are significantly different between primary and tertiary education and also between secondary and tertiary education. See Table 4.18 for the results of multiple-comparisons procedure applied to the differences among average private returns to primary, secondary and tertiary education for high income economies between 1997 and 2007.

Table 4.18 Results of Bonferroni's Multiple-Comparisons Procedure applied to the Observed Differences among Average Returns to Primary, Secondary and Tertiary Education for High Income Economies between 1997 and 2007.

Returns to High Income Economies
by Level of Education
(Bonferroni)

Row Mean- Col Mean	Primary	Secondary
Secondary	-.01095 1.000	
Tertiary	.069308 0.001	.080258 0.000

For additional clarity in the understanding of the differences among these groups, Figure 4.10 provides a sense of the variability of the average returns to education within groups representing different educational levels for high income economies between 1997 and 2007.

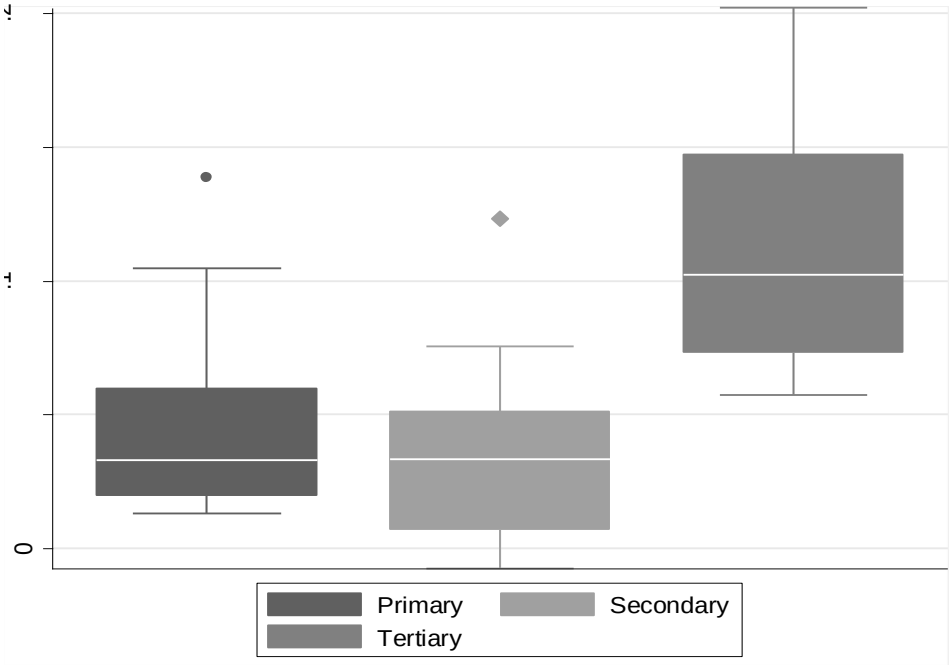

Figure 4.10 Average Returns to Education Showing the Variability of the Average Returns to Education within Groups Representing Different Educational Levels for High Income Economies between 1997 and 2007.

4.3.3 Comparisons of International Average Private Returns to Education by Level of Education

A significant difference was observed among international average private returns to education by educational level between 1997 and 2007. The pattern observed is consistent across stages of development. International private returns to tertiary education tend to be the highest with 12.1%, followed by returns to primary education of 6.2% and then followed by returns to secondary education of 4.9%. See Table 4.19 for

summary statistics of international average private returns to investments in education by educational level between 1997 and 2007.

Table 4.19 Summary Statistics for International Average Private Returns to Investments in Education by Educational Level between 1997 and 2007.

Educational Level	International Returns to Education		
	Mean	Std. Dev.	Freq.
Primary	.06209138	.06469237	58
Secondary	.04922373	.05629457	59
Tertiary	.1206614	.08933327	57
Total	.07691494	.0773974	174

Also, see Figure 4.11 for a graphic representation of international average private returns to investments in education by educational level between 1997 and 2007.

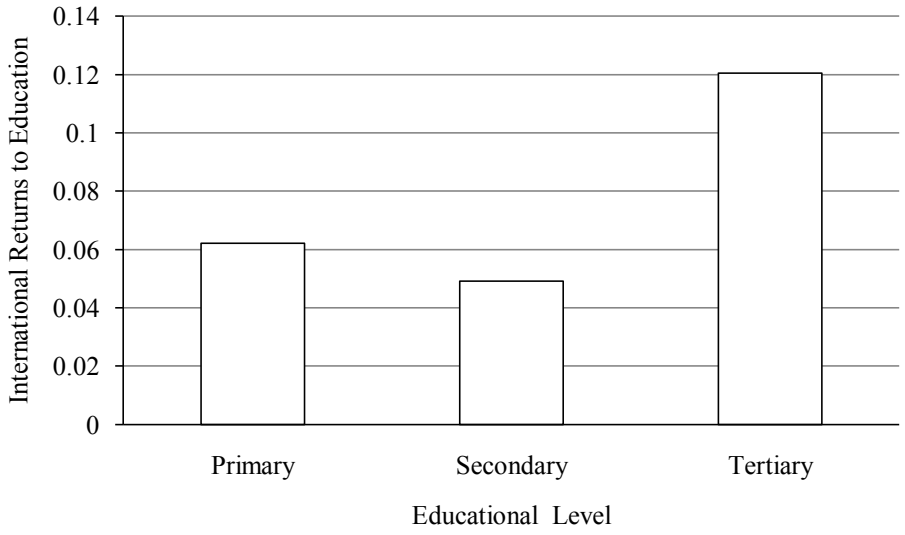

Figure 4.11 International Average Private Returns to Education by Educational Level between 1997 and 2007.

International average returns to education at different educational levels between 1997 and 2007 have been found to be significantly different F (2, 171) = 16.43, $p < .001$. See Table 4.20 for an Analysis of Variance table suggesting the statistically significant difference among international average returns to education at different educational levels between 1997 and 2007.

Table 4.20 Analysis of Variance Suggesting a Statistically Significant Difference among International Average Returns to Education at Different Educational Levels between 1997 and 2007.

Analysis of Variance

Source	SS	df	MS	F	Prob > F
Between groups	.167070113	2	.083535056	16.43	0.0001
Within groups	.869261622	171	.005083401		
Total	1.03633174	173	.005990357		

Once it was suggested that there is a significant difference among the returns, Bonferroni multiple-comparisons procedure was applied with the purpose of comparing each pair of means and determine the location of the differences among the observed returns. Through the application of the multiple-comparisons procedure, it was suggested that the differences in international returns to education at different educational levels between 1997 and 2007 are significant between primary and tertiary education and between secondary and tertiary education. See Table 4.21 for the results of the multiple-comparisons procedure applied to the observed differences among international average returns to education for the different educational levels between 1997 and 2007.

Table 4.21 Results of Bonferroni's Multiple Comparisons Procedure Applied to the Observed Differences among International Average Returns to Education for the Different Educational Levels between 1997 and 2007.

Comparison of International Returns to Education
by Educational Level
(Bonferroni)

Row Mean- Col Mean	Primary	Secondary
Secondary	-.012868 0.991	
Tertiary	.05857 0.000	.071438 0.000

For additional clarity in the understanding of the differences among these groups, Figure 4.12 provides a sense of the variability of international average returns to education among groups representing different educational levels between 1997 and 2007.

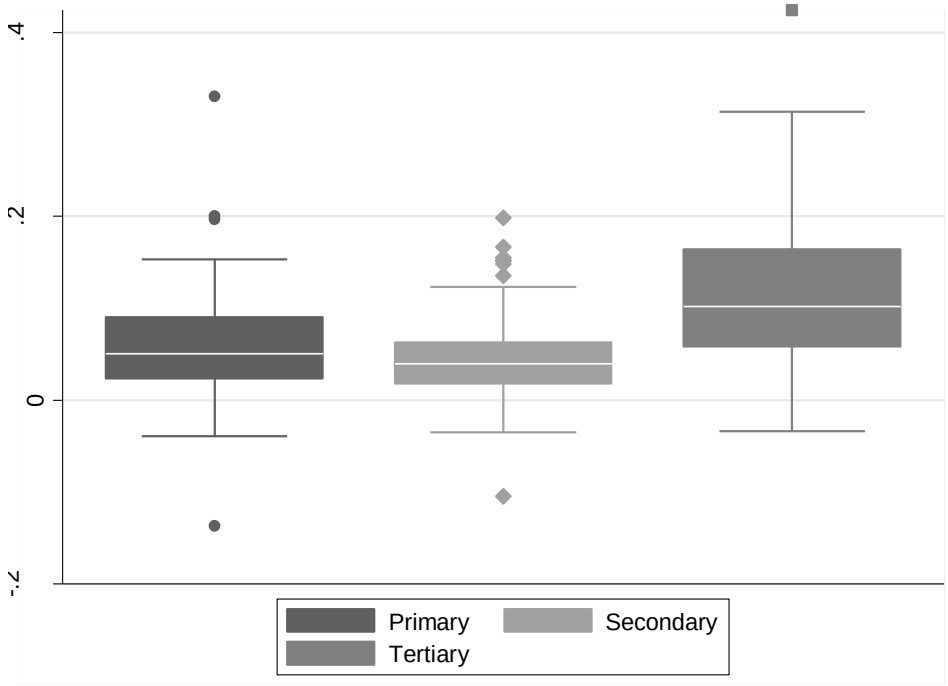

Figure 4.12 International Returns to Education Showing the Variability of Returns to Education among Groups Representing Different Educational Levels.

4.3.4 Private Returns to Investments in Primary, Secondary and Tertiary Education by Country Level of Economic Development

The following section provides an analysis of the returns to primary, secondary and tertiary education in countries at different levels of economic development.

4.3.4.1 *Private Returns to Primary Education by Country Level of Development*

With regards to primary education, low income economies show the highest private average returns to investments in education between 1997 and 2007 with an 8.5%, followed by high-middle income economies with 5.6%. Low-middle income economies exhibit 5.3% in private returns to investments in primary education, and high income economies a 4.7%. See table 4.22 for summary statistics of average private returns to primary education for countries at different levels of economic development between 1997 and 2007.

Table 4.22 Summary Statistics of Average Private Returns to Investments in Primary Education for Countries at Different Levels of Economic Development between 1997 and 2007.

Level of Development	Returns to Primary Education Mean	Std. Dev.	Freq.
Low Income	.08491111	.09800943	18
Low-Middle Income	.05313158	.04833286	19
High-Middle Income	.05581111	.01436345	9
High Income	.04675833	.03985995	12
Total	.06209138	.06469237	58

Also, see Figure 4.13 for a graphic representation of average private returns to investments in primary education for countries at different levels of economic development between 1997 and 2007.

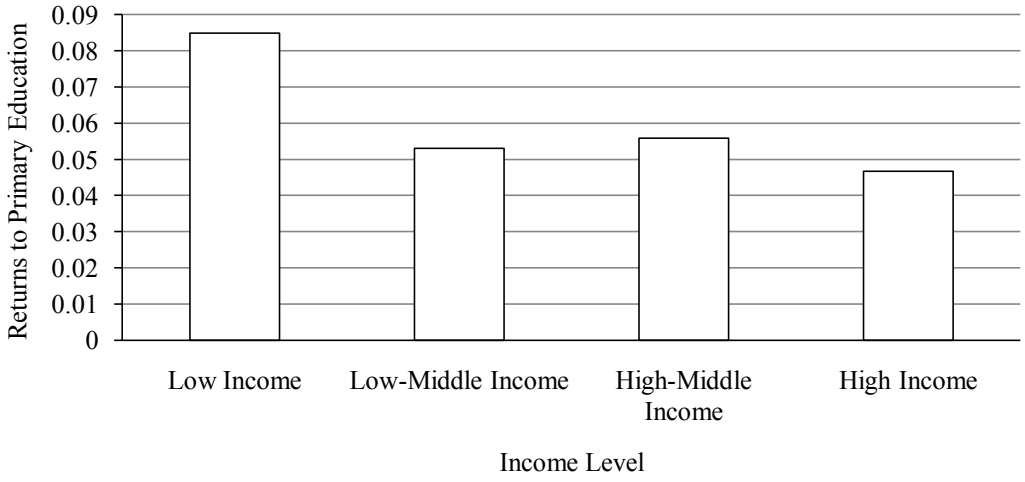

Figure 4.13 Average Private Returns to Primary Education for Countries at Different Levels of Development between 1997 and 2007.

The differences observed among average returns to primary education in countries at different levels of development between 1997 and 2007 are not statistically significant. See Table 4.23 for an Analysis of Variances table suggesting that the different average returns to primary education in countries at different levels of economic development between 1997 and 2007 are not statistically significant.

Table 4.23 Analysis of Variance Suggesting that the Differences in Average Returns to Primary Education in Countries at Different Levels of Economic Development between 1997 and 2007 Are Not Statistically Significant.

Analysis of Variance

Source	SS	df	MS	F	Prob > F
Between groups	.014074809	3	.004691603	1.13	0.3457
Within groups	.224476056	54	.004156964		
Total	.238550865	57	.004185103		

Given the fact that the differences among average returns to primary education in countries at different levels of development between 1997 and 2007 are not statistically significant, it will not be necessary to apply multiple-comparison procedures to this part of the analysis.

For additional clarity in the understanding of the non-significant differences among these groups, Figure 4.14 provides a sense of the variability of average returns to primary education within groups of countries at different levels of development between 1997 and 2007.

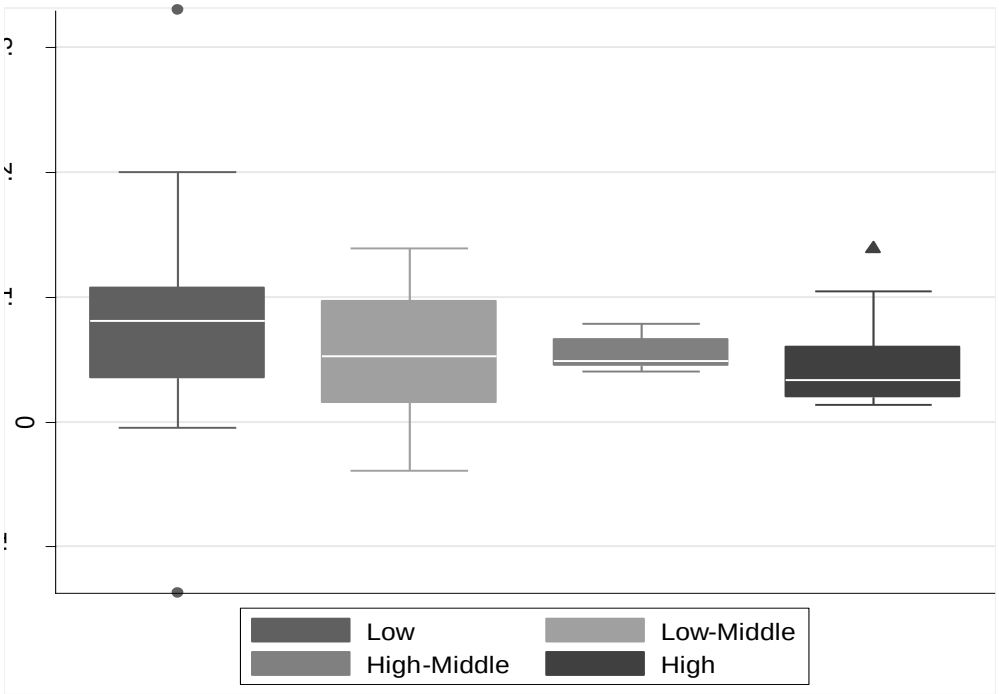

Figure 4.14 Average Private Returns to Primary Education for Countries at Different Levels of Development Showing the Variability of Average Returns to Primary Education within Groups of Countries at Different Levels of Economic Development between 1997 and 2007.

4.3.4.2 *Private Returns to Secondary Education by Country Level of Development*

With regards to average private investments in secondary education between 1997 and 2007, there is a 7.1% return for low income economies, 4.1% return for low-middle income economies, 4.1% for high-middle income economies, and 3.6% for high income economies. See Table 4.24 for summary statistics of average private returns to investments in secondary education for countries at different levels of economic development between 1997 and 2007.

Table 4.24 Summary Statistics of Average Private Returns to Investments in Secondary Education for Countries at Different Levels of Economic Development between 1997 and 2007.

Level of Development	Summary of Returns to Secondary Education		
	Mean	Std. Dev.	Freq.
Low Income	.07113333	.06476739	18
Low-Middle Income	.041385	.06170883	20
High-Middle Income	.04071111	.03926695	9
High Income	.03580833	.03708294	12
Total	.04922373	.05629457	59

Also, see Figure 4.15 for a graphic representation of average private returns to investment in secondary education for countries at different levels of economic development between 1997 and 2007.

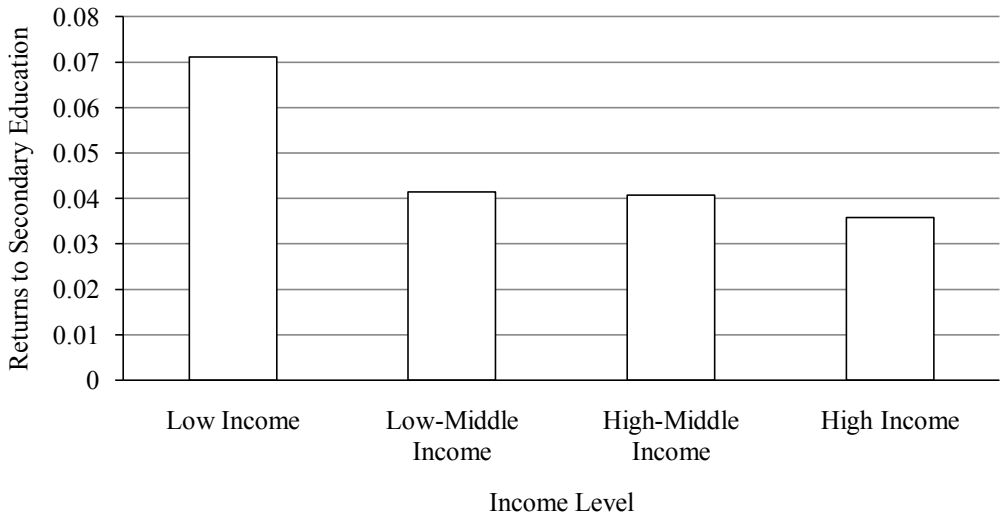

Figure 4.15 Average Private Returns to Secondary Education for Countries at Different Levels of Development between 1997 and 2007.

The differences observed among average returns to secondary education in countries at different levels of development between 1997 and 2007 are not statistically significant. See Table 4.25 for an Analysis of Variances table suggesting that the different average returns to secondary education in countries at different levels of economic development are not statistically significant.

Table 4.25 Analysis of Variance Suggesting that the Differences in Average Returns to Secondary Education in Countries at Different Levels of Economic Development between 1997 and 2007 Are Not Statistically Significant.

Analysis of Variance

Source	SS	df	MS	F	Prob > F
Between groups	.012681324	3	.004227108	1.36	0.2650
Within groups	.171125224	55	.003111368		
Total	.183806548	58	.003169078		

Given the fact that the differences among average returns to secondary education in countries at different levels of development between 1997 and 2007 are not statistically significant, it will not be necessary to apply multiple-comparison procedures to this part of the analysis.

For additional clarity in the understanding of the non-significant differences among these groups, Figure 4.16 provides a sense of the variability of average returns to secondary education within groups of countries at different levels of development between 1997 and 2007.

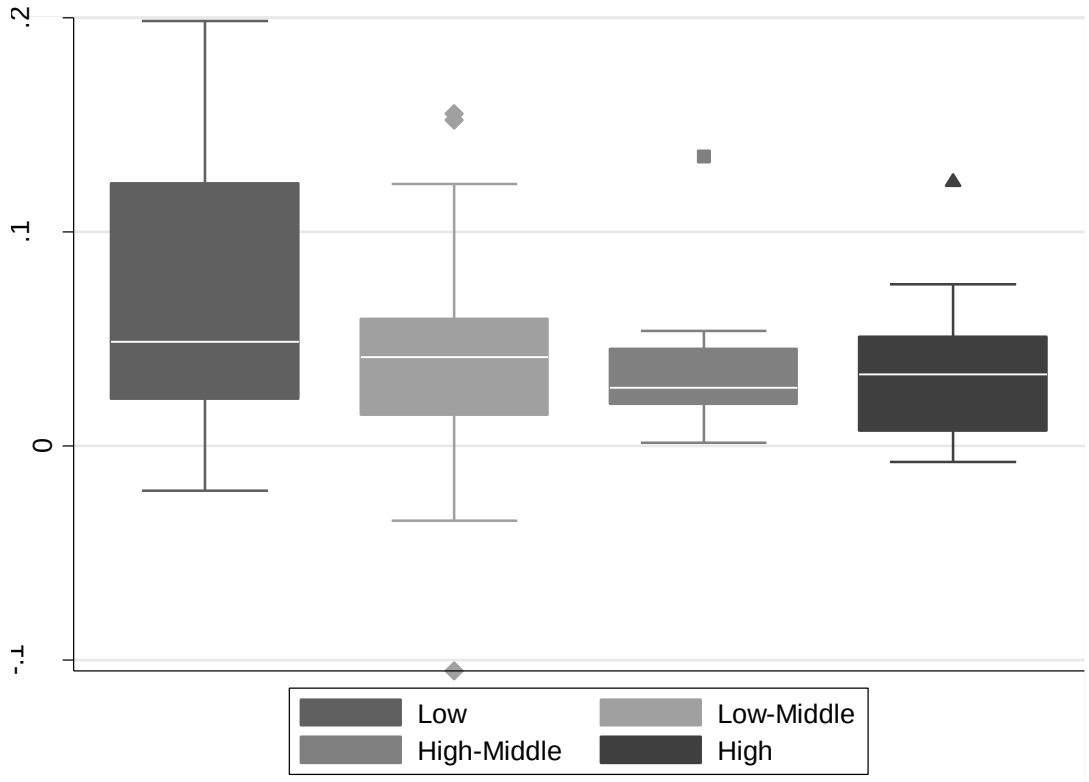

Figure 4.16 Average Private Returns to Secondary Education for Countries at Different Levels of Development Showing the Variability of Returns to Secondary Education within Groups of Countries at Different Levels of Development between 1997 and 2007.

4.3.4.3 *Private Returns to Tertiary Education by Country Level of Development*

Average private returns to tertiary education for low income economies between 1997 and 2007 have been observed to be 18.2%, 8.9% for low-middle income economies, 8.6% for high-middle income economies, and 11.6% for high income economies. See Table 4.26 for summary statistics of average private returns to investments in tertiary education in countries at different levels of economic development between 1997 and 2007.

Table 4.26 Summary Statistics of Average Private Returns to Tertiary Education for Countries at Different Levels of Economic Development between 1997 and 2007.

Level of Development	Summary of Returns to Tertiary Education Mean	Std. Dev.	Freq.
Low Income	.18203125	.11826581	16
Low-Middle Income	.089795	.06973204	20
High-Middle Income	.08627778	.05848724	9
High Income	.11606667	.049671	12
Total	.1206614	.08933327	57

Also, see Figure 4.17 for a graphic representation of average private returns to tertiary education in countries at different levels of economic development between 1997 and 2007.

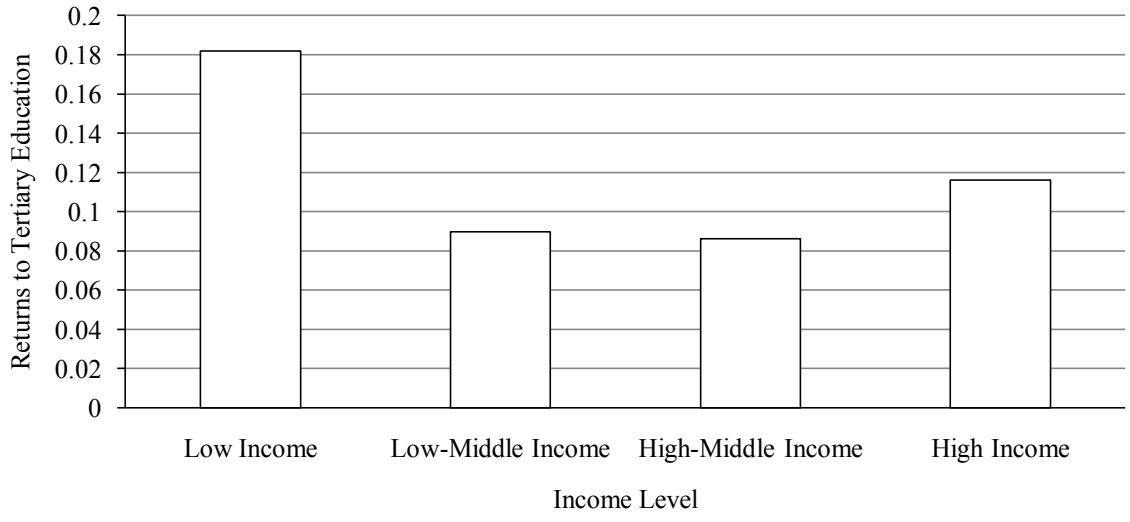

Figure 4.17 Average Private Returns to Tertiary Education for Countries at Different Levels of Development between 1997 and 2007.

Average returns to tertiary education for countries at different levels of development between 1997 and 2007 have been found to be significantly different F (3, 53) = 4.47, $p < .01$. See table 4.27 for an Analysis of Variance table suggesting the statistically significant differences among average returns to tertiary education for countries at different levels of economic development between 1997 and 2007.

Table 4.27 Analysis of Variance Suggesting the Statistically Significant Differences among Average Returns to Tertiary Education for Countries at Different Levels of Economic Development between 1997 and 2007.

Analysis of Variance					
Source	SS	df	MS	F	Prob > F
Between groups	.090208268	3	.030069423	4.47	0.0072
Within groups	.356695942	53	.006730112		
Total	.44690421	56	.007980432		

Once it was established that there is a significant difference among the returns, Bonferroni multiple-comparisons procedure was applied with the purpose of comparing each pair of means and determine the location of the differences among the observed returns. Through the application of the multiple-comparisons procedure, it was found that the differences in returns to tertiary education for countries at different levels of development are significant only between low and low-middle income economies, and between low and high-middle economies. See table 4.28 for the results of multiple-comparisons procedure applied to the differences among average returns to tertiary education for countries at different levels of economic development between 1997 and 2007.

Table 4.28 Results of Bonferroni's Multiple-Comparisons Procedure applied to the Observed Differences among Average Returns to Tertiary Education for Countries at Different Levels of Economic Development between 1997 and 2007.

Comparison of Returns to Tertiary Education
by Level of Development
(Bonferroni)

Row Mean- Col Mean	Low Income	Low-Middle Income	High-Middle Income
Low-Middle Income	-.092236 0.009		
High-Middle Income	-.095753 0.043	-.003517 1.000	
High Income	-.065965 0.240	.026272 1.000	.029789 1.000

For additional clarity and a sense of the variability of average returns to tertiary education within groups of countries at different levels of development between 1997 and 2007, see Figure 4.18.

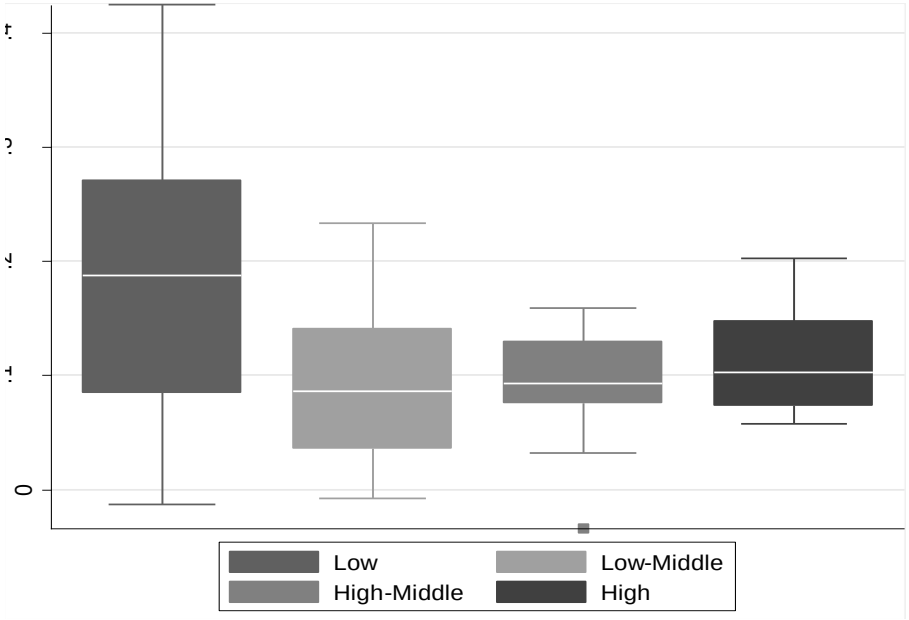

Figure 4.18 Average Private Returns to Tertiary Education for Countries at Different Levels or Development Showing the Variability of Returns to Tertiary Education within Groups of Countries at Different Levels of Economic Development between 1997 and 2007.

4.3.5 Returns to Investments in Education in Reference to the Immediate Lower Level of Education

At this point it is important to emphasize that generally speaking, there are gains in returns to a level of education in reference to the immediate lower level of education. It is understood that an increase in education is almost certain to provide a certain level of return in relation to lower levels of education. The issue is that gains are greater at some levels than others and in some countries when compared to others, particularly when the levels of economic development are different.

4.4 SUMMARY OF FINDINGS

Through this section, average private and social returns to investments in education between 1997 and 2007 have been estimated. Also, the patterns and differences among private returns have been observed in relation to the different educational levels and in countries at different levels of economic development.

4.4.1 Private Returns to Overall Investments in Education by Level of Economic Development

In this section, enough evidence has been provided to suggest that international average private returns to investments in education, when observed for countries at different levels of economic development, follow a U shape pattern. Returns are higher in countries at the lowest levels of development, these returns decrease as countries reach low-middle and high-middle income levels, and increase slightly as countries reach high income levels. However, the differences in international average private returns to education are only significant between low and low-middle income economies, low and high-middle income economies, and low and high income economies. The observed differences in returns to education among low-middle, high-middle and high income economies are not statistically significant.

4.4.1.1 *Private Returns to Investments in Primary, Secondary and Tertiary Education in Low Income Economies*

Regarding low income economies, returns to primary, secondary and tertiary education follow the international pattern also displaying a U shape with secondary education exhibiting the lowest returns and tertiary education the highest. And similar to the international pattern in returns to education, for low income economies, only the differences between returns to primary and tertiary education, and the differences between returns to secondary and tertiary education are statistically significant. The observed differences in average returns to investments in education between primary and secondary education between primary and secondary education are not statistically significant.

4.4.1.2 *Private Returns to Investments in Primary, Secondary and Tertiary Education in Low-Middle Income Economies*

Low-middle income economies also follow the international U pattern on average returns to primary, secondary and tertiary education. Returns at the tertiary level of education are the highest, followed by returns to primary education, and then followed by secondary education with the lowest returns. For low-middle income economies, only the difference in average returns to secondary and tertiary education is statistically significant. The differences in average private returns between primary and tertiary education, and the differences in the returns between primary and secondary, are not statistically significant.

4.4.1.3 *Private Returns to Investments in Primary, Secondary and Tertiary Education in High-Middle Income Economies*

The pattern in returns to different levels of education for high-middle income economies, with a U shape, also adheres to that of the international observations for returns to primary, secondary and tertiary education. Average returns to tertiary education for high-middle income economies are also highest, followed by returns to primary and then followed by returns to secondary education. However, statistical analysis suggests that the differences in returns to primary, secondary and tertiary education are not statistically significant for high-middle income economies.

4.4.1.4 *Private Returns to Investments in Primary, Secondary and Tertiary Education in High Income Economies*

With regards to high income economies, returns to primary, secondary and tertiary education follow the observed international pattern also displaying a U shape with secondary education exhibiting the lowest returns, and tertiary education the highest. And similar to the international pattern in returns to education, for high income economies, only the differences between average returns to primary and tertiary education, and the differences between average returns to secondary and tertiary education, are statistically significant. For high income economies, the observed differences in average returns to education between primary and secondary education are not significantly significant.

4.4.2 Private Returns to International Investments in Education by Level of Education

In this section, enough evidence has been provided to suggest that international average private returns to investments in education, when observed for countries at different levels of economic development, follow a U shape pattern with international average returns to secondary education being the lowest and tertiary education the highest. However, these differences are only statistically significant between primary and tertiary education, and between secondary and tertiary education. The differences between international average private returns to primary and secondary education are not statistically significant.

4.4.2.1 *Returns to Primary Education in Countries at Different Levels of Economic Development*

With regards to specific educational levels, international average private returns to primary education are suggested to be highest in low income economies, decrease for low-middle income economies, slightly increase for high-middle income economies, and decrease again for high income economies. However, statistical analysis suggests that the differences in returns to primary education among countries at different levels of economic development are not statistically significant.

4.4.2.2 *Returns to Secondary Education in Countries at Different Levels of Economic Development*

Regarding secondary education, international average private returns are suggested to be highest for low income economies, decrease to equal levels between low-middle and high-middle income economies and decrease again for high income economies. However, statistical analysis of suggests that the differences in returns to secondary education among countries at different levels of economic development are not statistically significant.

4.4.2.3 *Returns to Tertiary Education in Countries at Different Levels of Economic Development*

Concerning tertiary education, international average private returns are highest in low income economies, decreasing for low-middle and high-middle income economies, and then increasing for high income economies. Out of these differences, only returns between low and low-middle income economies, and between low and high-middle income economies, are statistically significant.

4.4.3 Private Returns to Investments in Different Levels of Education in Countries at Different Levels of Economic Development

The totality of this study may be summarized in Table 4.29; representing private returns to primary, secondary and tertiary education in countries with low, low-middle, high-middle and high income levels. Returns to education have been found to always be

highest at the tertiary level, followed by primary and lastly on secondary. This pattern is consistent in countries at all levels of economic development. International returns to investments in education present a U pattern as returns decrease for secondary education in relation to primary, and increase at the tertiary level, surpassing the returns to investing in primary education alone.

Table 4.29 Returns to Primary, Secondary and Tertiary Education in Countries at Low, Low-Middle, High-Middle, and High Income Levels of Development.

RETURNS TO INVESTMENS IN EDUCATION			
	Level of Education		
Level of Development	Primary	Secondary	Tertiary
High Income	.047	.036	.116
High-Middle Income	.056	.041	.086
Low-Middle Income	.053	.041	.090
Low Income	.085	.071	.182

.

4.5 CONCLUSION

In this section, average returns to investments in education for 59 countries at different levels of economic development between 1997 and 2007 were estimated. The returns were analyzed from the perspectives of groups of countries at different levels of development, and the perspective of different educational levels.

With regards to countries at different levels of economic development, returns to primary and secondary education are not significantly different. The observed significant difference is suggested to exist between returns to tertiary education for low and low-middle income economies and between low and high-middle income economies.

More important for this study are the findings of returns to primary, secondary and tertiary education for countries at different levels of economic development. At the international level, through statistical analyses, returns to tertiary education have been suggested to be the highest, regardless of the country's specific level of development.

Low income economies have been suggested to have the highest returns at the tertiary level, with the returns to this level being significantly different from returns to primary and secondary education. Low-middle income economies have also been observed to have the highest returns to education at the tertiary level. However, these differences are only significant between returns to secondary and tertiary education. Differences in returns between primary and secondary education, and between primary and tertiary education are not suggested to be statistically significant. Differences among average returns to primary, secondary and tertiary education for high-middle income economies have not been found to be statistically significant. And finally, differences in

returns to primary, secondary and tertiary education for high income economies have shown a trend parallel to low income economies in which returns to tertiary education are suggested to be significantly different from returns to primary and secondary education, while returns to primary and secondary education have not been suggested to be statistically significant.

5. CONCLUSION

Through this dissertation, the existence of controversies with regards to the sound allocation of resources in education has been established. These controversies refer to the allocation of resources to primary, secondary and tertiary levels of education in countries at different levels of economic development. The major controversies are found between the theories developed and established by Martin Carnoy and George Psacharopoulos. Carnoy (Carnoy, 1972, 1995a; Carnoy & Marenbach, 1975) suggested that returns to investments in education vary according to the level of development of the particular country being observed (Asaoka, 2006). On the other hand, Psacharopoulos (Psacharopoulos, 1981; Psacharopoulos & Patrinos, 2004) claimed that investments in education are always highest at the primary level, regardless of the particular country's level of development.

The results of numerous studies suggest the variability of returns to investments in education at the international level. These studies support conflicting patterns of returns to investments in education, and propagate the controversies regarding this issue. For instance, some suggest that returns to education are highest at the lower levels of education, and decrease as education increases (Hossain, 1997; Michaelowa, 2000; Sakellariou, 2003; T. P. Schultz, 1993). Others propose that returns are lowest at the lower levels of education and increase as education increases (Amaghionyeodiwe & Osinubi, 2007; Curtin & Nelson, 1999; Gibson & Fatai, 2006; Zhang & Zou, 2007). Another position in this debate suggests returns to education being non-linear; increasing

for secondary education with respect to primary, and decreasing for tertiary education (Heckman, et al., 2008; P. Trostel, 2005).

The controversies regarding the different patterns on returns to investments in education are certainly real. However, these controversies have been suggested to be the result of comparing results from studies conducted using different methodologies and data collection techniques (Amaghionyeodiwe & Osinubi, 2007; Harmon & Walker, 1999; Krueger & Lindahl, 2001). In the course of this dissertation these controversies were addressed through:

- The estimation of international returns to investments in education through a single methodology and with improvements in data comparability.
- The observation of the differences among the estimated returns and their statistical significance.
- The comparing of the newly estimated returns and their observed patterns with the hypotheses proposed by Carnoy and Psacharopoulos concerning investments in education.

5.1 ESTIMATING INTERNATIONAL RETURNS TO INVESTMENTS IN EDUCATION THROUGH A SINGLE METHODOLOGY AND WITH IMPROVEMENTS IN DATA COMPARABILITY

Through this dissertation, returns to investments in education were estimated using a single methodology and comparable data. In order to accomplish this, the short-cut method for estimating returns to investments in education was applied. Initially, the viability of the short-cut method as a reliable methodology for estimating returns to education was established. It is important to reiterate that the short-cut method, as well as the earnings function method, are derived from the Mincerian equation (Mincer, 1974); one of the most commonly estimated relationships in labor economics. The earnings function method relates the logarithm of earnings to schooling, years of work experience and years of work experience squared. The short-cut method is a simplified version of the Mincerian equation, and estimates private returns to education solely as the ratio of earnings and years in schooling. Despite its apparent simplicity, the viability of the short-cut method as a useful tool for estimating returns to education was established. This was accomplished by estimating and comparing the results between the returns to education for 28 countries with data available to be generated via both, the short-cut and earnings function methods, and suggesting that the results were significantly correlated. This substantiated and corroborated the available literature suggesting the viability of the short-cut method for estimating returns to education, especially when facing the challenge of data availability (Menon, 1997, 2008; Mincer, 1974); prevalent in less developed countries.

Once the viability of the short-cut method for estimating returns to education at the international level was established, returns were estimated for 59 countries at different levels of economic development. The returns were estimated using data from a single source: the International Labor Organization, thus making the estimates comparable. Returns to investments in education for 59 countries with a single methodology and comparable data have not been -to the current knowledge of the author- previously estimated. The fact that returns to education for 59 countries, with a single methodology and a single data collection technique, has never been attempted in the past, makes this research a valuable contribution to the dialogue on returns to investments in education at the international level (Amaghionyeodiwe & Osinubi, 2007; Carnoy, 1995b; Harmon & Walker, 1999; Heckman, et al., 2008; Krueger & Lindahl, 2001; Psacharopoulos & Patrinos, 2004).

5.2 OBSERVING THE DIFFERENCES AMONG THE ESTIMATED RETURNS TO INVESTMENTS IN EDUCATION AND THEIR STATISTICAL SIGNIFICANCE

Once estimates on returns to education for countries at different levels of economic development were generated (See Table 5.1), the statistical significant of their differences was tested.

Table 5.1 Returns to Primary, Secondary and Tertiary Education in Countries with Low, Low-Middle, High-Middle, and High Income Levels of Development Including Averages.

RETURNS TO INVESTMENS IN EDUCATION				
	Level of Education			
Level of Development	Primary	Secondary	Tertiary	Average
High Income	.047	.036	.116	.066
High-Middle Income	.056	.041	.086	.061
Low-Middle Income	.053	.041	.090	.061
Low Income	.085	.071	.182	.113
Average	.060	.047	.118	.075

5.2.1 International Average Returns to Investments in Education for Countries at Different Levels of Economic Development

Average returns to education for low income economies have shown a statistically significant difference with regards to returns to education for low-middle, high-middle and high income economies. Returns to education at the international level display a non-linear U shape pattern being higher for low income economies (11%), decreasing for low-middle and high-middle income economies (6% and 6% respectively) and increasing for high income economies (7%). However, as stated above,

these differences are only statistically significant between low income and the rest of the economies. This is to say, the differences observed in returns to investments in education for low-middle, high-middle and high income economies are not statistically significant. See Figure 5.1 for a graphic description of the non-linear, U shaped pattern displayed by returns to investments in education for low, low-middle, high-middle and high income economies.

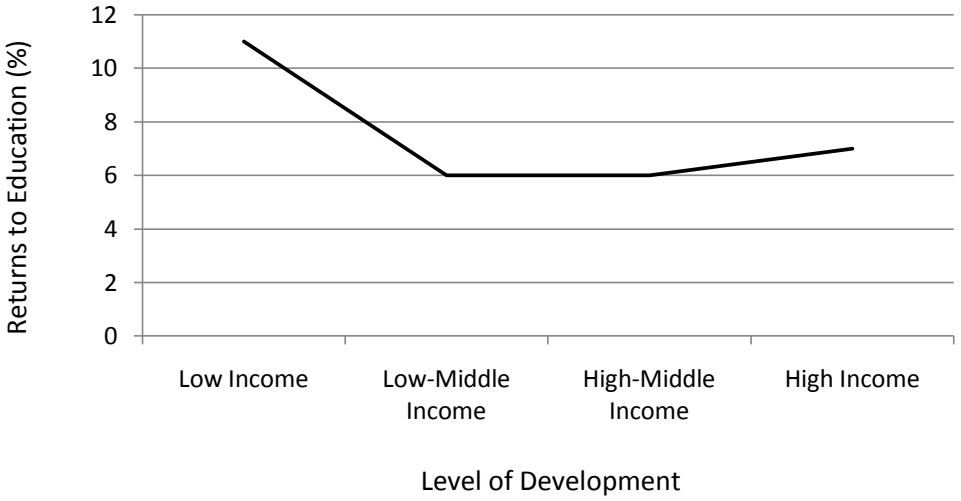

Figure 5.1 Graphic Description of the Non-Linear, U Shaped Pattern Displayed By Average Returns to Investments in Education for Low, Low-Middle, High-Middle and High Income Economies.

5.2.2 International Average Returns to Primary, Secondary and Tertiary Education

With regards to levels of education, the differences among international average returns to primary, secondary and tertiary education are only statistically significant between tertiary education and the remaining levels. This is to say that the differences

observed between average returns to investments in education at the primary and secondary levels are not statistically significant. International average returns to primary, secondary and tertiary education also display a U shape pattern showing the highest returns at the tertiary level (12%), followed by returns at the primary level (6%). The lowest average returns to education at the international level are found at the secondary level (5%). See Figure 5.2 for a graphic description of the non-linear, U shaped pattern displayed by average returns to investments in primary, secondary and tertiary education at the international level.

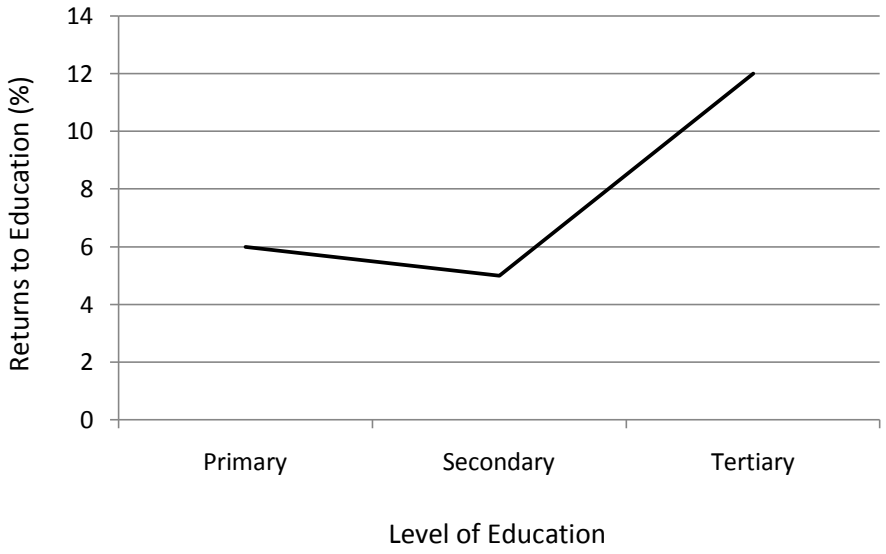

Figure 5.2 Graphic Description of the Non-Linear, U Shaped Pattern Displayed by International Average Returns to Investments in Primary, Secondary and Tertiary Levels of Education.

5.3 COMPARING THE NEWLY ESTIMATED RETURNS TO INVESTMENTS IN EDUCATION AND THEIR OBSERVED PATTERNS WITH THE HYPOTHESES PROPOSED BY CARNOY AND PSACHAROPOULOS CONCERNING RETURNS TO EDUCATION

The results of this study have also been compared with the main conflicting conclusions of other studies on returns to education; particularly those of Carnoy (Asaoka, 2006; Carnoy, 1995b; Carnoy & Marenbach, 1975; Ryoo, et al., 1993) and Psacharopoulos (Patrinos & Psacharopoulos, 2010; Psacharopoulos, 1972b, 1973, 1981, 1985, 1989, 1994, 1995; Psacharopoulos & Patrinos, 2004). And even though the results of this study are fairly aligned to those of Carnoy's, suggesting that returns to investments in education vary according to the level of development of the country being observed, the pattern suggested by the results of this study is different. The results of this study are more closely aligned with the results of the studies on returns to education conducted by Heckman, et al. (2008) and Trostel (2005). Similar to the results of this dissertation, Heckman, et al. and Trostel suggest non-linearity in returns to education. However, the authors suggest that the non-linearity is represented by an increase in returns to secondary education in relation to primary and a decrease in returns to tertiary education in relation to secondary. The non-linearity shown by the results of this dissertation suggests that returns are lowest at the secondary level in relation to primary and tertiary thus, displaying a U shape (See figure 5.2).

5.4 IMPLICATIONS FOR THEORY, RESEARCH AND POLICY

5.4.1 Implications for Theory

The results of this dissertation diverge from previously established theories regarding patterns in returns to education at the international level. Some studies on returns to education propose linear returns, either by suggesting that returns increase as education increases (Amaghionyeodiwe & Osinubi, 2007; Asaoka, 2006; Carnoy, 1995a, 1995b; Carnoy & Marenbach, 1975; Curtin & Nelson, 1999; Gibson & Fatai, 2006; Ryoo, et al., 1993; Zhang & Zou, 2007), or suggesting that returns decrease as education increases (Hossain, 1997; K. Lee & Psacharopoulos, 1979; Michaelowa, 2000; Patrinos & Psacharopoulos, 2010; Psacharopoulos, 1972b, 1973, 1981, 1985, 1989, 1994, 2006; Psacharopoulos & Patrinos, 2004; Sakellariou, 2003; T. P. Schultz, 1993). Studies suggesting non-linearity of returns to education propose these returns to increase for secondary education in relation to primary and decrease at the tertiary level (Heckman, et al., 2008; P. Trostel, 2005).

The results of this study provide evidence to suggest returns to investments in education to be non-linear, U shaped, with their pattern decreasing for secondary education and increasing considerably for tertiary education (See figure 5.2). Intuition and conventional wisdom suggest that returns to tertiary education being the highest is to be expected. This is due to the fact that a higher level of education is expected to yield higher returns. However, abundant literature on returns to education does not suggest this. As stated earlier, an extensive and widely accepted body of literature on returns to education suggests these returns to be highest at the primary level (Amaghionyeodiwe &

Osinubi, 2007; Asaoka, 2006; Carnoy, 1995a, 1995b; Carnoy & Marenbach, 1975; Curtin & Nelson, 1999; Gibson & Fatai, 2006; Ryoo, et al., 1993; Zhang & Zou, 2007). With regards to the non-linearity of these returns, again, the results of this study suggest returns to secondary education to be the lowest, whereas some literature suggests returns to education to be the highest at the secondary level (Heckman, et al., 2008; P. Trostel, 2005). These results must continue to be explored as theory on returns to investments in education continues to develop.

5.4.2 Implications for Research

This dissertation has been written with the intention of continuing the legacy set down by Martin Carnoy and George Psacharopoulos in the field of economics of education. Modern statistical tools and data availability have made conducting this study possible, and have opened a new window of opportunity in the expansion of comparative studies on returns to investment in education at the international level.

The results of this dissertation provide revised data regarding the estimation of returns to education. As it has been stated throughout this study, lower income economies tend to have a limited availability of data to be applied in the estimation of returns to education. Sophisticated, data rich methodologies have a limited application in the estimation of these returns, since the data necessary for their implementation is not always readily available. However, this study has suggested the viability of the short-cut method for estimating returns to education based on the Mincerian equation; a methodology that, apart from being easily implemented, has also shown to be effective

in the estimation of these returns, especially when faced by the challenge of limited data availability. The greatest advantage of applying the short-cut method to the estimation of returns to education, is that private returns can be estimated with data on schooling and wages only; making it especially attainable for lower income economies. Additionally, when data on expenditure per pupil in education are available, social returns to education can also be easily estimated. See equations 5.1 and 5.2

$$_{private}r_k = \frac{\overline{Y}_k - \overline{Y}_{(k-\Delta s)}}{S_k \cdot \overline{Y}_{(k-\Delta s)}} \tag{5.1}$$

$$_{social}r_k = \frac{\overline{Y}_k - \overline{Y}_{(k-\Delta s)}}{S_k \cdot (\overline{Y}_{(k-\Delta s)} + C_k)} \tag{5.2}$$

where *private* r_k is the private rate of return to investment in k level of education, $\overline{Y}_k$ is the mean earnings of individuals with a completed k level of education, Δ_s is the difference in years of schooling between k and the immediate lower level of education, S_k is the number of years in the subscripted educational level, *social* r_k is the social rate of return tto investment in education in k level of education, and C_k is the public expenditure per pupil in k level of education.

Additionally, the introduction of data on wages for individuals with an incomplete primary level of education provides a more accurate estimation of returns to primary education. When data on wages for individuals with an incomplete primary

level of education are integrated to the estimation of returns to primary education, the biases generally displayed by these estimations are addressed and minimized. These biases are addressed as the forgone earnings of individuals with an incomplete primary level of education are considered in the estimation of returns to primary education. This issue is important, since forgone earnings of individuals in the process of obtaining a primary level of education may vary based on the levels of development (and education attainment) of the different economies observed. This notion is recommended to be applied in further studies on returns to investments to primary education.

5.4.3 Implications for Policy

Through this dissertation, it has been suggested that historically, economies with high investments in human capital development, particularly in the form of formal education, have been observed to be most likely to take advantage of economic growth opportunities when they appear (Rodrik, 1995). Additionally, formal education has shown to be a pre-condition for economic growth and development (Lim, 1996; Mingat, 1998; Pack & Saggi, 2006). The results of this study may be used as the basis for industrial policies viewing education as a sector expected to offer good prospects for economic growth.

This dissertation also provides answers to the pressing question of *where* in education investments should be made in order to obtain the highest returns (Besley & Burgess, 2003; Lim, 1996). The results of this study not only provide an answer to the question of where in education returns are highest, but it also suggests where

investments should be made based on the specific characteristics of countries being observed (i.e. level of economic development) in order to obtain the highest returns. It is important to establish that the already existing classification of countries by level of development based on income alone provided by the World Bank, has the potential to bias the findings of this study. As it has been suggested, development is a multifaceted notion involving variables beyond income alone. The results of this study concerning the interplay of educational levels and levels of development must be carefully interpreted on a country by country basis, as industrial policies on the subject of investments in education are implemented.

The results of this dissertation provide evidence to suggest that low income economies display the highest returns to investments at all levels of education. This is beneficial, as it has been suggested that education is a pre-condition for economic growth and development. In this case, since education has shown to have high returns in developing economies, it would be easy to advocate for the establishment of industrial policies concerning the promotion of investments in education. These investments in education would provide high returns at the individual level, and prepare the economy as a whole for future growth and development opportunities when they arise (R. J. Barro & Lee, 2001; Cohn & Geske, 1990; Duflo, 2001; Harmon, et al., 2003; Johnes, 1993; Levin & Shank, 1970; McMahon, 2002; Norman, 1976; Sherman, 1994).

With regards to educational levels, it can be stated that returns to tertiary education are always the highest, regardless of the country's level of economic development. The challenge set by this conclusion is the promotion of educational

policies allowing individuals to overcome the internal and external challenges set before them (i.e. individual ability, access to wealth, parents' education, quality of education, compulsory education laws, distance to school, density of students per school, and civic participation, among others) regarding continuous, uninterrupted education, in order for them to take full advantage of the highest returns yielded by tertiary education (Card, 1995, 2001; Currie & Moretti, 2003; Dee, 2004; Duflo, 2001; Hanushek & Zhang, 2009; Harmon, et al., 2001; Harmon, et al., 2003; Katz & Autor, 1999; J. W. Lee & Barro, 1997; Leigh & Ryan, 2008; Salas, 2004; US Department of Labor, 2000). Furthermore, high returns to tertiary education, measured as a function of wages and time spent in school, does not provide strong evidence to suggest increased investments in tertiary education at the national level. In other words, high returns to tertiary education do not imply individuals having made investments in the educational system belonging to the economy in which they labor. Out of country education and the characteristics of the local economy must be analyzed as investments in tertiary education are considered.

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APPENDIX 1

SUMMARY STATISTICS PER COUNTRY AND PER YEAR FOR THE DATA USED IN THE PRELIMINARY STUDY SUGGESTING THE VIABILITY OF THE SHORT-CUT METHOD FOR ESTIMATING RETURNS TO INVESTMENTS IN EDUCATION

country = Australia, year = 1985

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	680	6.289124	.807499	2.581969	9.649254
preprimary	680	.0058824	.0765269	0	1
primary	680	.5558824	.4972331	0	1
secondary	680	.3764706	.4848569	0	1
tertiary	680	.0617647	.2409049	0	1
exp	680	21.73382	11.47468	2	48
exp2	680	603.8338	555.0582	4	2304
female	680	.3779412	.4852297	0	1
married	680	.7514706	.4324784	0	1
public	637	.4254317	.4947968	0	1
union	680	.5161765	.5001061	0	1

country = Australia, year = 1986

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	532	6.194989	.6579973	2.238869	9.167987
preprimary	532	.0075188	.0864657	0	1
primary	532	.5	.5004706	0	1
secondary	532	.406015	.4915496	0	1
tertiary	532	.0864662	.2813157	0	1
exp	532	20.95677	11.16222	2	48
exp2	532	563.547	537.6434	4	2304
female	532	.3796992	.4857688	0	1
married	532	.6973684	.4598295	0	1
public	525	.4057143	.4914981	0	1
union	532	.4906015	.5003822	0	1

country = Australia, year = 1987

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	768	6.373481	.7751989	2.877949	9.458177
preprimary	768	.0091146	.0950962	0	1
primary	768	.4830729	.500039	0	1
secondary	768	.4348958	.4960664	0	1
tertiary	768	.0729167	.2601691	0	1
exp	768	21.33984	10.95875	3	48
exp2	768	575.3268	528.1183	9	2304
female	768	.4179688	.4935464	0	1
married	768	.6080729	.4884987	0	1
public	733	.4051842	.4912629	0	1
union	768	.4153646	.4931059	0	1

country = Australia, year = 1990

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	1023	6.615944	.7976707	2.748872	9.775122
preprimary	1023	.0175953	.1315394	0	1
primary	1023	.4731183	.4995211	0	1
secondary	1023	.4056696	.4912613	0	1
tertiary	1023	.1036168	.3049119	0	1
exp	1023	22.56794	11.00325	2	55
exp2	1023	630.2649	536.3024	4	3025
female	1023	.3998045	.4900976	0	1
married	1023	.7781036	.4157251	0	1
public	934	.4678801	.4992346	0	1
union	1023	.4623656	.4988255	0	1

country = Australia, year = 1992

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	990	6.663925	.7926137	1.467939	9.695848
preprimary	990	.0131313	.1138946	0	1
primary	990	.4575758	.4984487	0	1
secondary	990	.4353535	.4960538	0	1
tertiary	990	.0939394	.2918918	0	1
exp	990	24.83939	10.55964	2	49
exp2	990	728.3889	541.3881	4	2401
female	990	.4131313	.4926449	0	1
married	990	.7505051	.4329394	0	1
public	906	.4966887	.5002652	0	1
union	990	.4909091	.50017	0	1

country = Australia, year = 1994

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	793	6.682549	.7794852	1.467939	9.775654
preprimary	793	.0138714	.1170309	0	1
primary	793	.4552333	.4983062	0	1
secondary	793	.4312736	.4955667	0	1
tertiary	793	.0996217	.2996839	0	1
exp	793	25.80454	10.21726	3	47
exp2	793	770.1349	535.2636	9	2209
female	793	.4262295	.4948401	0	1
married	793	.7629256	.4255567	0	1
public	732	.5177596	.5000262	0	1
union	793	.5081967	.5002483	0	1

country = WGermany, year = 1985

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	385	3.753269	.6710865	.8393298	5.519191
preprimary	385	.0051948	.0719811	0	1
primary	385	.7350649	.4418729	0	1
secondary	385	.1636364	.3704267	0	1
tertiary	385	.0961039	.2951172	0	1
exp	385	24.70909	11.86353	2	47
exp2	385	750.9169	607.5477	4	2209
female	385	.3714286	.4838154	0	1
married	385	.6701299	.4707775	0	1
public	371	.328841	.4704265	0	1
union	385	.3454545	.476135	0	1

country = WGermany, year = 1986

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	968	3.910099	.4820563	1.702376	5.509038
preprimary	968	0	0	0	0
primary	968	.7510331	.4326381	0	1
secondary	968	.1952479	.3965964	0	1
tertiary	968	.053719	.2255789	0	1
exp	968	23.34504	11.13807	2	47
exp2	968	668.9194	548.8855	4	2209
female	968	.3719008	.483562	0	1
married	968	.6477273	.4779253	0	1
public	0				
union	968	.3119835	.4635426	0	1

country = WGermany, year = 1987

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	417	3.936181	.5180544	1.568616	5.570251
preprimary	417	0	0	0	0
primary	417	.8201439	.3845289	0	1
secondary	417	.1079137	.310644	0	1
tertiary	417	.0719424	.258703	0	1
exp	417	25.86331	11.73436	4	47
exp2	417	806.2758	627.9152	16	2209
female	417	.4364508	.4965408	0	1
married	417	.6450839	.4790626	0	1
public	411	.2919708	.4552231	0	1
union	417	.3189448	.4666275	0	1

country = WGermany, year = 1989

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	387	4.065726	.4412739	2.552526	5.570251
preprimary	387	.002584	.0508329	0	1
primary	387	.8165375	.3875463	0	1
secondary	387	.1369509	.3442406	0	1
tertiary	387	.0439276	.2051994	0	1
exp	387	23.45995	11.62833	3	47
exp2	387	685.2377	596.2805	9	2209
female	387	.4289406	.4955655	0	1
married	387	.6098191	.4884221	0	1
public	371	.2587601	.438545	0	1
union	387	.372093	.4839887	0	1

country = WGermany, year = 1990

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	812	4.089779	.4830262	1.820509	5.626822
preprimary	812	.0012315	.0350931	0	1
primary	812	.7401478	.4388236	0	1
secondary	812	.1674877	.3736409	0	1
tertiary	812	.091133	.2879755	0	1
exp	812	23.19458	11.4506	2	47
exp2	812	668.9433	578.0897	4	2209
female	812	.3780788	.4852063	0	1
married	812	.5849754	.49303	0	1
public	809	.3114957	.4633914	0	1
union	812	.3263547	.4691678	0	1

country = WGermany, year = 1991

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	507	4.198592	.4605963	1.905123	5.744605
preprimary	507	0	0	0	0
primary	507	.7100592	.4541828	0	1
secondary	507	.1873767	.390599	0	1
tertiary	507	.1025641	.3036884	0	1
exp	507	23.40237	11.57993	2	47
exp2	507	681.501	584.3576	4	2209
female	507	.3708087	.4834984	0	1
married	507	.6232742	.4850438	0	1
public	470	.3468085	.4764613	0	1
union	507	.3195266	.4667538	0	1

country = WGermany, year = 1992

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	755	4.199436	.4743735	1.974081	5.736305
preprimary	755	.002649	.0514344	0	1
primary	755	.7721854	.4197004	0	1
secondary	755	.1337748	.3406359	0	1
tertiary	755	.0913907	.288355	0	1
exp	755	23.34702	11.50165	2	49
exp2	755	677.196	589.9414	4	2401
female	755	.4291391	.4952814	0	1
married	755	.6092715	.4882371	0	1
public	705	.2780142	.4483385	0	1
union	755	.3562914	.4792202	0	1

country = WGermany, year = 1993

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	317	4.280099	.4266242	2.995732	5.703783
preprimary	317	.0094637	.0969733	0	1
primary	317	.7507886	.4332403	0	1
secondary	317	.1735016	.379279	0	1
tertiary	317	.0662461	.2491049	0	1
exp	317	24.07886	10.94651	1	47
exp2	317	699.2397	559.5066	1	2209
female	317	.3817035	.4865725	0	1
married	317	.615142	.487331	0	1
public	316	.2594937	.4390521	0	1
union	317	.4069401	.4920402	0	1

country = WGermany, year = 1995

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	559	4.289727	.5613947	2.384229	6.843217
preprimary	559	.0161002	.1259736	0	1
primary	559	.6296959	.4833186	0	1
secondary	559	.2110912	.4084485	0	1
tertiary	559	.1431127	.3505014	0	1
exp	559	24.27191	11.31471	3	49
exp2	559	716.9195	583.2339	9	2401
female	559	.3846154	.48694	0	1
married	559	.6726297	.4696739	0	1
public	544	.3584559	.4799883	0	1
union	559	.4132379	.4928558	0	1

country = GB, year = 1985

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	576	5.250492	.5383132	2.405172	6.830794
preprimary	576	0	0	0	0
primary	576	.703125	.4572781	0	1
secondary	576	.296875	.4572781	0	1
tertiary	576	0	0	0	0
exp	576	23.24306	11.32031	3	45
exp2	576	668.1667	552.685	9	2025
female	576	.4618056	.4989724	0	1
married	576	.7638889	.4250604	0	1
public	565	.3646018	.4817448	0	1
union	576	.4826389	.5001328	0	1

country = GB, year = 1986

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	592	5.33958	.5598432	2.825315	6.905485
preprimary	592	0	0	0	0
primary	592	.7246622	.4470621	0	1
secondary	592	.2753378	.4470621	0	1
tertiary	592	0	0	0	0
exp	592	23.83446	11.13597	3	45
exp2	592	691.8818	557.2735	9	2025
female	592	.4442568	.4973032	0	1
married	592	.8091216	.3933258	0	1
public	576	.3645833	.4817315	0	1
union	592	.4780405	.49994	0	1

country = GB, year = 1987

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	520	5.427314	.5460211	3.526761	7.171484
preprimary	520	0	0	0	0
primary	520	.6461538	.4786226	0	1
secondary	520	.3538462	.4786226	0	1
tertiary	520	0	0	0	0
exp	520	23.83077	11.21511	3	45
exp2	520	693.4423	551.5279	9	2025
female	520	.4980769	.5004778	0	1
married	520	.7538462	.431184	0	1
public	508	.3937008	.4890514	0	1
union	520	.475	.4998555	0	1

country = GB, year = 1988

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	538	5.544729	.5433165	3.688879	7.328104
preprimary	538	0	0	0	0
primary	538	.6263941	.4842111	0	1
secondary	538	.3736059	.4842111	0	1
tertiary	538	0	0	0	0
exp	538	22.66357	11.07988	3	45
exp2	538	636.1729	533.0819	9	2025
female	538	.4869888	.5002959	0	1
married	538	.760223	.4273446	0	1
public	510	.4039216	.4911639	0	1
union	538	.472119	.4996867	0	1

country = GB, year = 1989

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	535	5.530396	.5768316	2.741644	7.244227
preprimary	535	0	0	0	0
primary	535	.6915888	.4622696	0	1
secondary	535	.3084112	.4622696	0	1
tertiary	535	0	0	0	0
exp	535	24.13458	10.76775	3	45
exp2	535	698.2056	527.2768	9	2025
female	535	.4691589	.499515	0	1
married	535	.7813084	.4137458	0	1
public	524	.3320611	.4714028	0	1
union	535	.4373832	.4965279	0	1

country = GB, year = 1990

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	470	5.711918	.5255304	3.912023	7.305786
preprimary	470	0	0	0	0
primary	470	.6446809	.4791199	0	1
secondary	470	.3553191	.4791199	0	1
tertiary	470	0	0	0	0
exp	470	23.71064	10.69151	3	45
exp2	470	676.2596	523.4048	9	2025
female	470	.5361702	.4992214	0	1
married	470	.8042553	.3971956	0	1
public	463	.3671706	.482555	0	1
union	470	.4234043	.4946247	0	1

country = GB, year = 1991

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	384	5.791885	.5684638	4.19377	7.600903
preprimary	384	0	0	0	0
primary	384	.5677083	.4960407	0	1
secondary	384	.4322917	.4960407	0	1
tertiary	384	0	0	0	0
exp	384	22.6875	11.20501	3	45
exp2	384	639.9479	549.5376	9	2025
female	384	.5208333	.5002175	0	1
married	384	.6484375	.4780811	0	1
public	377	.3899204	.4883801	0	1
union	384	.6692708	.4710895	0	1

country = GB, year = 1992

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	365	5.815052	.5551462	3.871201	7.248682
preprimary	365	0	0	0	0
primary	365	.5780822	.4945435	0	1
secondary	365	.4219178	.4945435	0	1
tertiary	365	0	0	0	0
exp	365	23.67397	10.70871	3	45
exp2	365	674.8192	535.0952	9	2025
female	365	.4876712	.5005341	0	1
married	365	.7369863	.4408741	0	1
public	358	.396648	.4898864	0	1
union	365	.4575342	.4988773	0	1

country = GB, year = 1993

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	418	5.946094	.583491	3.625154	7.536364
preprimary	418	0	0	0	0
primary	418	.6291866	.4836014	0	1
secondary	418	.3708134	.4836014	0	1
tertiary	418	0	0	0	0
exp	418	22.72727	10.74613	3	45
exp2	418	631.7321	513.6987	9	2025
female	418	.4856459	.5003928	0	1
married	418	.7248804	.4471097	0	1
public	418	.3038278	.4604603	0	1
union	418	.4066986	.4918064	0	1

country = GB, year = 1994

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	396	5.89794	.5929468	4.081922	7.532898
preprimary	396	0	0	0	0
primary	396	.5252525	.4999936	0	1
secondary	396	.4747475	.4999936	0	1
tertiary	396	0	0	0	0
exp	396	22.14141	10.63527	3	45
exp2	396	603.0657	521.7277	9	2025
female	396	.5176768	.5003196	0	1
married	396	.6843434	.4653648	0	1
public	0				
union	396	.4545455	.4985595	0	1

country = GB, year = 1995

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	395	5.885603	.5543794	3.680581	7.408531
preprimary	395	0	0	0	0
primary	395	.5974684	.4910299	0	1
secondary	395	.4025316	.4910299	0	1
tertiary	395	0	0	0	0
exp	395	22.16203	10.64609	3	45
exp2	395	604.2076	513.6088	9	2025
female	395	.5518987	.4979299	0	1
married	395	.6886076	.4636501	0	1
public	0				
union	395	.3848101	.4871675	0	1

country = USA, year = 1985

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	313	5.833866	.8571388	2.290163	7.414667
preprimary	313	.0031949	.0565233	0	1
primary	313	.1565495	.3639574	0	1
secondary	313	.571885	.4955979	0	1
tertiary	313	.2683706	.4438211	0	1
exp	313	21.09904	11.02851	1	49
exp2	313	566.4089	536.8098	1	2401
female	313	.3450479	.4761451	0	1
married	313	.6134185	.4877461	0	1
public	313	.2076677	.4062871	0	1
union	313	.1916933	.3942634	0	1

country = USA, year = 1986

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	611	5.849562	.9310636	2.079442	9.368945
preprimary	611	.0081833	.0901645	0	1
primary	611	.1342062	.341153	0	1
secondary	611	.599018	.4904989	0	1
tertiary	611	.2585925	.4382199	0	1
exp	611	18.91489	10.35228	2	49
exp2	611	464.7676	471.2785	4	2401
female	611	.4811784	.500055	0	1
married	611	.5957447	.4911494	0	1
public	611	.202946	.4025222	0	1
union	611	.1669394	.3732273	0	1

country = USA, year = 1987

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	749	5.902835	.8542286	.9262149	8.881836
preprimary	749	.0066756	.0814854	0	1
primary	749	.1228304	.3284618	0	1
secondary	749	.5874499	.4926221	0	1
tertiary	749	.2830441	.4507787	0	1
exp	749	19.26969	10.54374	2	48
exp2	749	482.3431	468.6328	4	2304
female	749	.5113485	.5002052	0	1
married	749	.5313752	.4993481	0	1
public	0				
union	749	.200267	.4004676	0	1

country = USA, year = 1988

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	628	5.968341	.7615837	2.628316	8.087774
preprimary	628	.0079618	.0889437	0	1
primary	628	.1353503	.3423701	0	1
secondary	628	.6019108	.4898942	0	1
tertiary	628	.2547771	.4360832	0	1
exp	628	19.85987	10.51904	2	52
exp2	628	504.8885	483.449	4	2704
female	628	.5015924	.500396	0	1
married	628	.5429936	.4985452	0	1
public	0				
union	628	.1321656	.3389407	0	1

country = USA, year = 1989

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	643	6.008	.8935286	1.714798	8.634976
preprimary	643	.0093313	.0962215	0	1
primary	643	.1104199	.3136564	0	1
secondary	643	.5832037	.4934124	0	1
tertiary	643	.2970451	.4573123	0	1
exp	643	19.70451	10.19329	1	54
exp2	643	492.0093	465.0017	1	2916
female	643	.4914463	.500316	0	1
married	643	.5769829	.4944227	0	1
public	0				
union	643	.1104199	.3136564	0	1

country = USA, year = 1990

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	552	6.005394	.8645268	2.428148	9.368945
preprimary	552	.0018116	.0425628	0	1
primary	552	.115942	.3204458	0	1
secondary	552	.6268116	.4840902	0	1
tertiary	552	.2554348	.4365009	0	1
exp	552	18.98913	9.652768	2	45
exp2	552	453.5942	425.5506	4	2025
female	552	.5181159	.5001249	0	1
married	552	.5434783	.4985579	0	1
public	0				
union	552	.1105072	.3138053	0	1

country = USA, year = 1991

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	575	6.176002	.8810465	2.525729	10.44508
preprimary	575	.0052174	.0721056	0	1
primary	575	.093913	.2919617	0	1
secondary	575	.6121739	.4876788	0	1
tertiary	575	.2886957	.4535507	0	1
exp	575	19.32696	10.15254	2	51
exp2	575	476.4261	447.3305	4	2601
female	575	.5304348	.4995074	0	1
married	575	.5513043	.497794	0	1
public	0				
union	575	.1617391	.3685319	0	1

country = USA, year = 1992

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	585	6.194469	.8997125	1.617218	9.258542
preprimary	585	.0034188	.0584205	0	1
primary	585	.1025641	.3036483	0	1
secondary	585	.5846154	.49321	0	1
tertiary	585	.3094017	.4626426	0	1
exp	585	18.98632	10.27098	2	46
exp2	585	465.7932	450.8958	4	2116
female	585	.5521368	.4976999	0	1
married	585	.5846154	.49321	0	1
public	0				
union	585	.1538462	.36111	0	1

country = USA, year = 1993

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	704	6.238767	.7778398	2.476343	9.368945
preprimary	704	.0014205	.0376889	0	1
primary	704	.09375	.2916878	0	1
secondary	704	.5738636	.4948657	0	1
tertiary	704	.3309659	.4708954	0	1
exp	704	20.23153	10.22418	2	47
exp2	704	513.7003	456.5373	4	2209
female	704	.5198864	.4999596	0	1
married	704	.5639205	.4962499	0	1
public	0				
union	704	.0923295	.2896964	0	1

country = USA, year = 1994

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	696	6.217372	.8182899	1.748413	8.881836
preprimary	696	.0043103	.0655587	0	1
primary	696	.1106322	.3139017	0	1
secondary	696	.5876437	.4926127	0	1
tertiary	696	.2974138	.4574489	0	1
exp	696	21.02443	10.29986	2	52
exp2	696	547.9612	494.0771	4	2704
female	696	.5344828	.4991682	0	1
married	696	.5258621	.4996898	0	1
public	0				
union	696	.0531609	.2245156	0	1

country = USA, year = 1995

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	348	5.820752	.7502585	2.525729	9.076809
preprimary	348	0	0	0	0
primary	348	.1149425	.3194118	0	1
secondary	348	.6724138	.4700088	0	1
tertiary	348	.2126437	.4097668	0	1
exp	348	18.37069	10.54005	1	48
exp2	348	448.2557	449.9494	1	2304
female	348	.6321839	.4829053	0	1
married	348	.408046	.4921794	0	1
public	0				
union	348	.0890805	.28527	0	1

country = Austria, year = 1985

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	292	5.642509	.5837935	3.665163	7.247763
preprimary	292	0	0	0	0
primary	292	.1849315	.3889085	0	1
secondary	292	.8150685	.3889085	0	1
tertiary	292	0	0	0	0
exp	292	21.66096	11.28869	4	46
exp2	292	596.1952	534.0414	16	2116
female	292	.3835616	.4870879	0	1
married	292	.6369863	.4816943	0	1
public	0				
union	292	.5342466	.4996821	0	1

country = Austria, year = 1986

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	292	5.619776	.504064	4.230477	8.314252
preprimary	292	0	0	0	0
primary	292	.2363014	.4255387	0	1
secondary	292	.7636986	.4255387	0	1
tertiary	292	0	0	0	0
exp	292	22.16438	11.21243	4	46
exp2	292	616.5479	531.9784	16	2116
female	292	.3835616	.4870879	0	1
married	292	.6609589	.4741965	0	1
public	0				
union	292	.5924658	.4922193	0	1

country = Austria, year = 1988

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	350	5.67417	.4946413	2.931194	7.285049
preprimary	350	.0028571	.0534522	0	1
primary	350	.7742857	.4186503	0	1
secondary	350	.1571429	.3644564	0	1
tertiary	350	.0657143	.2481367	0	1
exp	350	22.14	11.38291	2	47
exp2	350	619.38	558.9837	4	2209
female	350	.4	.4905993	0	1
married	350	.6628571	.4734109	0	1
public	350	.2314286	.4223494	0	1
union	350	.4885714	.500585	0	1

country = Austria, year = 1989

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	622	5.789829	.5426322	3.198256	7.600903
preprimary	622	0	0	0	0
primary	622	.7491961	.4338247	0	1
secondary	622	.181672	.3858843	0	1
tertiary	622	.0691318	.2538824	0	1
exp	622	23.09325	11.59853	2	47
exp2	622	667.6077	580.0586	4	2209
female	622	.426045	.4948984	0	1
married	622	.6446945	.478991	0	1
public	621	.3558776	.4791643	0	1
union	622	.5659164	.4960349	0	1

country = Austria, year = 1991

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	317	6.046247	.5960453	3.506558	9.649254
preprimary	317	0	0	0	0
primary	317	.70347	.4574495	0	1
secondary	317	.214511	.4111317	0	1
tertiary	317	.0820189	.2748274	0	1
exp	317	22.73502	10.39714	4	44
exp2	317	624.6404	490.873	16	1936
female	317	.4195584	.4942669	0	1
married	317	.6056782	.4894772	0	1
public	317	.3280757	.4702549	0	1
union	317	.5015773	.500788	0	1

country = Austria, year = 1992

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	358	5.964705	.5400759	3.198256	7.926632
preprimary	358	0	0	0	0
primary	358	.7458101	.4360143	0	1
secondary	358	.1815642	.3860245	0	1
tertiary	358	.0726257	.2598843	0	1
exp	358	22.2933	10.25613	4	46
exp2	358	601.8855	494.3409	16	2116
female	358	.4776536	.5001995	0	1
married	358	.6256983	.4846194	0	1
public	356	.3651685	.4821551	0	1
union	358	.5083799	.5006295	0	1

country = Austria, year = 1994

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	280	6.139601	.5286704	4.353856	7.600903
preprimary	280	.0035714	.0597614	0	1
primary	280	.3785714	.4858995	0	1
secondary	280	.5178571	.5005757	0	1
tertiary	280	.1	.3005372	0	1
exp	280	23.39643	10.70641	3	45
exp2	280	661.6107	521.31	9	2025
female	280	.4464286	.4980119	0	1
married	280	.7285714	.4454929	0	1
public	277	.3574007	.4801016	0	1
union	280	.4607143	.4993467	0	1

country = Austria, year = 1995

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	340	6.079381	.5906786	4.422849	9.21034
preprimary	340	.0058824	.0765833	0	1
primary	340	.6058824	.4893805	0	1
secondary	340	.3029412	.4602073	0	1
tertiary	340	.0852941	.2797305	0	1
exp	340	24.52941	10.97311	4	48
exp2	340	721.7471	562.922	16	2304
female	340	.4529412	.4985142	0	1
married	340	.6294118	.4836741	0	1
public	340	.3382353	.4738063	0	1
union	340	.6205882	.4859558	0	1

country = Hungary, year = 1990

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	523	5.167115	.5734102	3.014937	8.013747
preprimary	523	.0057361	.0755921	0	1
primary	523	.5277247	.4997087	0	1
secondary	523	.3479924	.4767896	0	1
tertiary	523	.1185468	.323564	0	1
exp	523	23.49904	10.31169	4	51
exp2	523	658.3327	524.426	16	2601
female	523	.4856597	.5002728	0	1
married	523	.7724665	.4196411	0	1
public	507	.9072978	.2903011	0	1
union	523	0	0	0	0

country = Hungary, year = 1994

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	452	6.152203	.5282721	3.994952	8.108262
preprimary	452	.0044248	.0664452	0	1
primary	452	.5774336	.494515	0	1
secondary	452	.3252212	.4689765	0	1
tertiary	452	.0929204	.2906425	0	1
exp	452	24.11947	10.11459	3	44
exp2	452	683.8274	499.7743	9	1936
female	452	.4955752	.5005344	0	1
married	452	.7367257	.440898	0	1
public	432	1	0	1	1
union	452	.6172566	.486595	0	1

country = Hungary, year = 1995

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	320	6.221386	.6059156	3.865833	8.779557
preprimary	320	.003125	.0559017	0	1
primary	320	.478125	.5003036	0	1
secondary	320	.40625	.4919015	0	1
tertiary	320	.1125	.3164755	0	1
exp	320	22.40312	9.463839	4	48
exp2	320	591.1844	434.2321	16	2304
female	320	.5375	.4993726	0	1
married	320	.603125	.4900159	0	1
public	317	1	0	1	1
union	320	.2875	.4533055	0	1

country = Netherlands, year = 1988

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	522	6.650218	.4878915	4.163235	8.030993
preprimary	522	.0172414	.1302944	0	1
primary	522	.3735632	.4842137	0	1
secondary	522	.3563218	.4793713	0	1
tertiary	522	.2528736	.435076	0	1
exp	522	18.90613	11.10415	2	48
exp2	522	480.5077	492.9935	4	2304
female	522	.3697318	.4831951	0	1
married	522	.6532567	.4763897	0	1
public	512	.3320313	.4714027	0	1
union	522	.3448276	.475768	0	1

country = Netherlands, year = 1989

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	538	6.664836	.4368865	5.164786	8.150949
preprimary	538	.0204461	.1416522	0	1
primary	538	.4237918	.4946181	0	1
secondary	538	.3587361	.4800759	0	1
tertiary	538	.197026	.3981223	0	1
exp	538	19.71561	11.24714	1	48
exp2	538	514.9684	510.5811	1	2304
female	538	.3289963	.4702859	0	1
married	538	.6282528	.4837211	0	1
public	526	.3098859	.4628866	0	1
union	538	.3141264	.464599	0	1

country = Netherlands, year = 1991

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	535	7.211688	.740313	5.338323	9.574984
preprimary	535	.0130841	.1137414	0	1
primary	535	.3046729	.4606995	0	1
secondary	535	.3757009	.4847566	0	1
tertiary	535	.3065421	.461489	0	1
exp	535	18.74953	10.76063	2	49
exp2	535	467.1196	473.7675	4	2401
female	535	.4018692	.4907346	0	1
married	535	.6336449	.482259	0	1
public	519	.2447013	.4303248	0	1
union	535	.3065421	.461489	0	1

country = Netherlands, year = 1993

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	602	7.293081	.7145618	5.164786	9.646442
preprimary	602	.0083056	.0908315	0	1
primary	602	.3089701	.4624531	0	1
secondary	602	.4152824	.4931805	0	1
tertiary	602	.2674419	.4429929	0	1
exp	602	19.96678	10.23804	1	50
exp2	602	503.3156	445.7211	1	2500
female	602	.3903654	.4882379	0	1
married	602	.6511628	.4769987	0	1
public	518	.3011583	.4592048	0	1
union	602	.3421927	.4748383	0	1

country = Netherlands, year = 1994

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	602	7.304197	.6907316	5.164786	9.646442
preprimary	602	.0083056	.0908315	0	1
primary	602	.269103	.4438624	0	1
secondary	602	.4285714	.4952832	0	1
tertiary	602	.2940199	.4559798	0	1
exp	602	19.40365	10.88122	1	49
exp2	602	494.706	481.8408	1	2401
female	602	.3853821	.4870902	0	1
married	602	.5880399	.4925973	0	1
public	581	.2254733	.4182537	0	1
union	602	.3322259	.4714032	0	1

country = Netherlands, year = 1995

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	683	7.496884	.7953577	5.646624	10.79446
preprimary	683	0	0	0	0
primary	683	.2547584	.4360447	0	1
secondary	683	.3792094	.4855459	0	1
tertiary	683	.3660322	.4820715	0	1
exp	683	19.55344	9.872263	1	46
exp2	683	479.6559	424.5879	1	2116
female	683	.3792094	.4855459	0	1
married	683	.625183	.4844304	0	1
public	662	.2854985	.451993	0	1
union	683	.3587116	.4799738	0	1

country = Italy, year = 1987

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	310	.2527257	.7787696	-1.750938	2.381088
preprimary	310	0	0	0	0
primary	310	.3806452	.4863305	0	1
secondary	310	.6193548	.4863305	0	1
tertiary	310	0	0	0	0
exp	310	22.25161	10.50972	5	38
exp2	310	605.2323	482.1923	25	1444
female	310	.3516129	.4782458	0	1
married	310	.6774194	.4682196	0	1
public	306	.503268	.5008083	0	1
union	310	.4032258	.4913385	0	1

country = Italy, year = 1989

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	363	1.294594	.6223987	-.8758852	3.336659
preprimary	363	.107438	.3100967	0	1
primary	363	.3030303	.4602025	0	1
secondary	363	.3746556	.484702	0	1
tertiary	363	.214876	.4113032	0	1
exp	363	22.49036	11.7681	1	50
exp2	363	643.9229	586.4121	1	2500
female	363	.4104683	.4925977	0	1
married	363	.6804408	.4669495	0	1
public	363	.5895317	.4925977	0	1
union	363	.4187328	.4940324	0	1

country = Italy, year = 1991

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	334	1.571861	.6029508	-.2468601	3.825011
preprimary	334	.0898204	.2863532	0	1
primary	334	.2874251	.4532405	0	1
secondary	334	.3592814	.4805097	0	1
tertiary	334	.2634731	.4411777	0	1
exp	334	22.18263	11.60328	1	50
exp2	334	626.3024	574.119	1	2500
female	334	.4401198	.4971462	0	1
married	334	.6616766	.473849	0	1
public	331	.5770393	.4947773	0	1
union	334	.4311377	.4959783	0	1

country = Italy, year = 1992

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	321	1.574651	.6311547	-.3140805	3.378725
preprimary	321	0	0	0	0
primary	321	.2149533	.4114313	0	1
secondary	321	.4922118	.5007199	0	1
tertiary	321	.2928349	.4557738	0	1
exp	321	18.79751	9.563576	2	36
exp2	321	444.5234	379.1365	4	1296
female	321	.376947	.4853781	0	1
married	321	.6417445	.4802363	0	1
public	305	.4163934	.4937705	0	1
union	321	.3676012	.4829048	0	1

country = Italy, year = 1993

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	334	1.575819	.5876042	-.6931472	4.183957
preprimary	334	.1167665	.3216236	0	1
primary	334	.3892216	.4883053	0	1
secondary	334	.3353293	.4728138	0	1
tertiary	334	.1586826	.3659281	0	1
exp	334	23.67365	12.17804	2	49
exp2	334	708.3024	636.1983	4	2401
female	334	.3652695	.4822281	0	1
married	334	.6586826	.4748631	0	1
public	333	.4204204	.4943693	0	1
union	334	.4041916	.4914712	0	1

country = Italy, year = 1994

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	360	1.61727	.5237348	-.8532326	3.181135
preprimary	360	.0833333	.2767701	0	1
primary	360	.3805556	.4861992	0	1
secondary	360	.4027778	.4911394	0	1
tertiary	360	.1333333	.3404078	0	1
exp	360	23.34444	11.18112	0	49
exp2	360	669.6333	560.6804	0	2401
female	360	.3694444	.4833261	0	1
married	360	.6861111	.4647177	0	1
public	353	.4447592	.4976445	0	1
union	360	.3277778	.4700567	0	1

country = Ireland, year = 1988

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	316	5.239076	.684812	3.015935	7.783224
preprimary	316	0	0	0	0
primary	316	.2911392	.4550081	0	1
secondary	316	.5443038	.4988232	0	1
tertiary	316	.164557	.3713683	0	1
exp	316	18.03165	11.36155	0	47
exp2	316	453.8165	506.4841	0	2209
female	316	.471519	.4999799	0	1
married	316	.5949367	.4916829	0	1
public	313	.3929712	.4891926	0	1
union	316	.4462025	.4978858	0	1

country = Ireland, year = 1989

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	319	5.604834	.8731843	1.894346	10.53948
preprimary	319	.0062696	.0790562	0	1
primary	319	.4200627	.4943441	0	1
secondary	319	.3949843	.4896154	0	1
tertiary	319	.1786834	.3836888	0	1
exp	319	20.53918	11.14559	1	48
exp2	319	545.6928	521.6333	1	2304
female	319	.4012539	.4909223	0	1
married	319	.6050157	.4896154	0	1
public	319	.3949843	.4896154	0	1
union	319	.507837	.500724	0	1

country = Ireland, year = 1990

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	330	5.53317	.7882234	2.238047	7.418581
preprimary	330	0	0	0	0
primary	330	.4181818	.4940094	0	1
secondary	330	.430303	.4958704	0	1
tertiary	330	.1515152	.3590948	0	1
exp	330	20.05455	11.27159	2	48
exp2	330	528.8485	532.9758	4	2304
female	330	.4333333	.4962881	0	1
married	330	.5848485	.4934964	0	1
public	330	.4060606	.4918419	0	1
union	330	.4636364	.4994332	0	1

country = Ireland, year = 1993

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	316	5.462831	.5914402	3.665163	8.070906
preprimary	316	0	0	0	0
primary	316	.3734177	.4844788	0	1
secondary	316	.5189873	.5004318	0	1
tertiary	316	.1075949	.3103596	0	1
exp	316	20.88924	10.79228	1	49
exp2	316	552.4652	488.6205	1	2401
female	316	.4525316	.4985311	0	1
married	316	.5727848	.4954586	0	1
public	315	.3428571	.4754195	0	1
union	316	0	0	0	0

country = Ireland, year = 1994

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	273	5.506895	.6616946	3.101093	7.706263
preprimary	273	.003663	.0605228	0	1
primary	273	.2600733	.43948	0	1
secondary	273	.6007326	.4906473	0	1
tertiary	273	.1355311	.3429186	0	1
exp	273	21.17216	10.9156	1	45
exp2	273	566.9744	494.6985	1	2025
female	273	.4615385	.4994341	0	1
married	273	.6556777	.4760194	0	1
public	269	.3420074	.4752663	0	1
union	273	.4505495	.4984624	0	1

country = Ireland, year = 1995

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	378	5.811647	.8146867	2.361239	8.61943
preprimary	378	.0026455	.0514344	0	1
primary	378	.2566138	.4373433	0	1
secondary	378	.4708995	.499814	0	1
tertiary	378	.2698413	.4444655	0	1
exp	378	19.39153	11.35771	0	49
exp2	378	504.6878	494.3751	0	2401
female	378	.4285714	.4955276	0	1
married	378	.6243386	.4849351	0	1
public	378	.3492063	.4773511	0	1
union	378	.457672	.4988654	0	1

country = Norway, year = 1989

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	790	8.567364	.4264053	5.221356	10.36302
preprimary	790	0	0	0	0
primary	790	.7139241	.4522116	0	1
secondary	790	.2860759	.4522116	0	1
tertiary	790	0	0	0	0
exp	790	23.54304	10.57474	5	48
exp2	790	665.9582	537.8656	25	2304
female	790	.4696203	.4993924	0	1
married	790	.7620253	.4261133	0	1
public	790	.3949367	.4891468	0	1
union	790	.6367089	.4812524	0	1

country = Norway, year = 1990

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	668	8.469081	.5735073	5.876129	11.69525
preprimary	668	0	0	0	0
primary	668	.5464072	.4982148	0	1
secondary	668	.2994012	.458339	0	1
tertiary	668	.1541916	.3614029	0	1
exp	668	22.78743	10.96839	4	46
exp2	668	639.3922	547.0726	16	2116
female	668	.4461078	.4974596	0	1
married	668	.7724551	.4195614	0	1
public	661	.5007564	.5003781	0	1
union	668	.6362275	.4814447	0	1

country = Norway, year = 1991

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	612	8.471437	.539077	6.028821	11.15625
preprimary	612	0	0	0	0
primary	612	.369281	.4830049	0	1
secondary	612	.4411765	.4969339	0	1
tertiary	612	.1895425	.3922595	0	1
exp	612	20.86111	11.23555	3	48
exp2	612	561.2173	550.3246	9	2304
female	612	.4591503	.4987361	0	1
married	612	.8039216	.3973533	0	1
public	605	.5206612	.4999863	0	1
union	612	.6552288	.4756824	0	1

country = Norway, year = 1992

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	653	8.502951	.4597905	6.632725	10.12663
preprimary	653	0	0	0	0
primary	653	.3660031	.4820796	0	1
secondary	653	.4287902	.4952826	0	1
tertiary	653	.2052067	.4041622	0	1
exp	653	21.45636	11.09123	3	47
exp2	653	583.2021	523.6916	9	2209
female	653	.5022971	.500378	0	1
married	653	.8085758	.3937237	0	1
public	645	.5054264	.5003586	0	1
union	653	.6401225	.4803322	0	1

country = Norway, year = 1993

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	594	8.562968	.4294524	6.907755	10.02127
preprimary	594	.003367	.0579769	0	1
primary	594	.3383838	.4735586	0	1
secondary	594	.4175084	.4935638	0	1
tertiary	594	.2407407	.4278935	0	1
exp	594	21.3771	10.76716	3	47
exp2	594	572.7172	507.4928	9	2209
female	594	.483165	.5001377	0	1
married	594	.8030303	.3980444	0	1
public	584	.5291096	.4995798	0	1
union	594	.6818182	.466163	0	1

country = Norway, year = 1994

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	932	8.580357	.4609918	6.958391	10.63152
preprimary	932	0	0	0	0
primary	932	.2703863	.4443978	0	1
secondary	932	.4688841	.4992988	0	1
tertiary	932	.2607296	.4392684	0	1
exp	932	21.22961	10.30329	2	46
exp2	932	556.7403	474.028	4	2116
female	932	.5	.5002685	0	1
married	932	.6266094	.4839642	0	1
public	885	.5062147	.5002441	0	1
union	932	.6319742	.4825273	0	1

country = Norway, year = 1995

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	634	8.610795	.4803073	6.907755	11.26607
preprimary	634	0	0	0	0
primary	634	.2429022	.4291751	0	1
secondary	634	.5094637	.5003051	0	1
tertiary	634	.2476341	.4319789	0	1
exp	634	20.52839	10.02351	1	46
exp2	634	521.7271	451.3409	1	2116
female	634	.4574132	.4985764	0	1
married	634	.5930599	.4916514	0	1
public	620	.483871	.5001433	0	1
union	634	.6356467	.4816283	0	1

country = Switzerland, year = 1987

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	409	4.250297	.5460224	1.735001	5.991465
preprimary	409	.0146699	.120375	0	1
primary	409	.6723716	.4699233	0	1
secondary	409	.190709	.3933413	0	1
tertiary	409	.1222494	.3279748	0	1
exp	409	22.67237	10.60915	3	48
exp2	409	626.3154	517.486	9	2304
female	409	.3080685	.4622605	0	1
married	409	.591687	.4921236	0	1
public	400	.295	.4566139	0	1
union	409	.3814181	.4863297	0	1

country = Slovenia, year = 1993

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	397	6.87979	.5616721	5.387929	9.350102
preprimary	397	.0277078	.1643415	0	1
primary	397	.4987406	.5006293	0	1
secondary	397	.3929471	.4890215	0	1
tertiary	397	.0806045	.2725703	0	1
exp	397	21.47859	8.88522	4	43
exp2	397	540.0781	395.4849	16	1849
female	397	.4785894	.5001717	0	1
married	397	.790932	.4071562	0	1
public	389	.8586118	.3488702	0	1
union	397	.6851385	.4650467	0	1

country = Slovenia, year = 1994

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	397	6.87979	.5616721	5.387929	9.350102
preprimary	397	.0277078	.1643415	0	1
primary	397	.4987406	.5006293	0	1
secondary	397	.3929471	.4890215	0	1
tertiary	397	.0806045	.2725703	0	1
exp	397	21.47859	8.88522	4	43
exp2	397	540.0781	395.4849	16	1849
female	397	.4785894	.5001717	0	1
married	397	.790932	.4071562	0	1
public	389	.8586118	.3488702	0	1
union	397	.6851385	.4650467	0	1

country = Slovenia, year = 1995

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	346	7.098662	.5431735	5.298317	9.087442
preprimary	346	.0028902	.0537603	0	1
primary	346	.5231214	.5001885	0	1
secondary	346	.3728324	.4842584	0	1
tertiary	346	.1011561	.301972	0	1
exp	346	21.47399	9.47648	4	44
exp2	346	550.6763	432.5891	16	1936
female	346	.5578035	.4973668	0	1
married	346	.8063584	.3957236	0	1
public	341	.8328446	.3736629	0	1
union	346	.6907514	.4628532	0	1

country = Sweden, year = 1994

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	604	6.001754	.4464524	3.871201	8.294049
preprimary	604	.013245	.1144171	0	1
primary	604	.4536424	.498259	0	1
secondary	604	.3791391	.4855749	0	1
tertiary	604	.1539735	.3612225	0	1
exp	604	24.51821	11.05503	4	51
exp2	604	723.154	570.4309	16	2601
female	604	.5364238	.4990849	0	1
married	604	.7516556	.4324107	0	1
public	591	.5296108	.4995452	0	1
union	604	.8675497	.3392607	0	1

country = Sweden, year = 1995

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	589	5.983544	.3517635	4.710531	7.495542
preprimary	589	.0237691	.1524585	0	1
primary	589	.4125637	.492714	0	1
secondary	589	.3921902	.4886537	0	1
tertiary	589	.1714771	.3772457	0	1
exp	589	23.85908	11.32613	4	54
exp2	589	697.3192	585.5693	16	2916
female	589	.5297114	.4995407	0	1
married	589	.7198642	.4494471	0	1
public	586	.5255973	.499771	0	1
union	589	.8709677	.3355206	0	1

country = CzechRep, year = 1994

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	414	4.700019	.4567496	2.582071	6.583603
preprimary	414	0	0	0	0
primary	414	.2681159	.4435143	0	1
secondary	414	.5120773	.5004589	0	1
tertiary	414	.2198068	.4146167	0	1
exp	414	21.75121	10.79339	2	45
exp2	414	589.3309	478.1828	4	2025
female	414	.4879227	.5004589	0	1
married	414	.7512077	.4328362	0	1
public	410	.6146341	.4872762	0	1
union	414	.410628	.492543	0	1

country = CzechRep, year = 1995

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	374	4.896429	.4630481	3.485939	7.320601
preprimary	374	.0026738	.0517088	0	1
primary	374	.1898396	.3926994	0	1
secondary	374	.6229947	.4852855	0	1
tertiary	374	.184492	.3884045	0	1
exp	374	22.09358	11.08627	1	47
exp2	374	610.7032	513.3598	1	2209
female	374	.4197861	.4941849	0	1
married	374	.7513369	.4328171	0	1
public	373	.5656836	.4963327	0	1
union	374	.4037433	.4913044	0	1

country = Poland, year = 1991

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	406	3.432409	.5813492	1.418818	5.221356
preprimary	406	.0024631	.0496292	0	1
primary	406	.4753695	.5000091	0	1
secondary	406	.4039409	.4912913	0	1
tertiary	406	.1182266	.3232746	0	1
exp	406	22.01232	9.357236	3	47
exp2	406	571.8842	452.0554	9	2209
female	406	.4630542	.4992484	0	1
married	406	.7881773	.409104	0	1
public	406	.8571429	.3503588	0	1
union	406	.3349754	.4725642	0	1

country = Poland, year = 1992

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	606	3.712032	.6025966	1.467939	5.416101
preprimary	606	.0033003	.057401	0	1
primary	606	.6155116	.486876	0	1
secondary	606	.3382838	.4735165	0	1
tertiary	606	.0429043	.2028087	0	1
exp	606	23.5396	9.479386	4	47
exp2	606	643.8234	475.0447	16	2209
female	606	.4933993	.5003694	0	1
married	606	.7574257	.4289938	0	1
public	601	.7737105	.4187772	0	1
union	606	.3564356	.4793417	0	1

country = Poland, year = 1993

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	625	4.019757	.6638179	2.140466	6.571283
preprimary	625	.0048	.0691709	0	1
primary	625	.544	.4984592	0	1
secondary	625	.3728	.4839368	0	1
tertiary	625	.0784	.2690153	0	1
exp	625	23.4688	9.642624	4	54
exp2	625	643.616	490.631	16	2916
female	625	.5232	.4998615	0	1
married	625	.7888	.4084869	0	1
public	620	.7919355	.406251	0	1
union	625	.3408	.4743579	0	1

country = Poland, year = 1994

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	559	4.245124	.6355218	2.281966	6.417132
preprimary	559	.0035778	.0597612	0	1
primary	559	.4794275	.500024	0	1
secondary	559	.3631485	.4813379	0	1
tertiary	559	.1538462	.3611244	0	1
exp	559	23.36315	9.248586	4	51
exp2	559	631.22	453.4139	16	2601
female	559	.4722719	.4996777	0	1
married	559	.7584973	.4283777	0	1
public	558	.688172	.4636556	0	1
union	559	.3291592	.4703288	0	1

country = Poland, year = 1995

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	579	4.460235	.6202382	1.568616	6.437752
preprimary	579	.0017271	.0415586	0	1
primary	579	.4611399	.4989186	0	1
secondary	579	.3972366	.4897489	0	1
tertiary	579	.1398964	.3471794	0	1
exp	579	23.13817	9.400816	3	47
exp2	579	623.5976	459.5178	9	2209
female	579	.5025907	.5004256	0	1
married	579	.7702936	.4210077	0	1
public	576	.703125	.4572781	0	1
union	579	.2815199	.4501293	0	1

country = NewZealand, year = 1991

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	447	6.640424	.7172977	3.778491	9.903487
preprimary	447	0	0	0	0
primary	447	.4004474	.4905381	0	1
secondary	447	.4496644	.4980173	0	1
tertiary	447	.1498881	.3573617	0	1
exp	447	21.71588	11.04018	1	47
exp2	447	593.1924	515.0674	1	2209
female	447	.4899329	.5004588	0	1
married	447	.787472	.4095547	0	1
public	429	.5081585	.5005171	0	1
union	447	.4563758	.4986514	0	1

country = NewZealand, year = 1992

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	503	6.685195	.6368303	4.625373	9.551267
preprimary	503	.0417495	.2002153	0	1
primary	503	.3558648	.4792512	0	1
secondary	503	.4135189	.4929545	0	1
tertiary	503	.1888668	.3917924	0	1
exp	503	21.68787	11.25545	0	47
exp2	503	596.7972	517.3885	0	2209
female	503	.4751491	.4998792	0	1
married	503	.6799205	.4669712	0	1
public	459	.4248366	.4948575	0	1
union	503	.4095427	.492239	0	1

country = NewZealand, year = 1993

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	519	6.667151	.6455859	4.045554	9.769957
preprimary	519	.0096339	.0977728	0	1
primary	519	.3622351	.48111	0	1
secondary	519	.4450867	.4974549	0	1
tertiary	519	.1830443	.3870759	0	1
exp	519	22.57418	11.26214	1	53
exp2	519	636.185	531.0073	1	2809
female	519	.5510597	.4978659	0	1
married	519	.7418112	.4380606	0	1
public	480	.4854167	.5003087	0	1
union	519	.4181118	.4937246	0	1

country = NewZealand, year = 1994

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	441	6.739179	.7726386	4.224779	10.34977
preprimary	441	.0294785	.1693355	0	1
primary	441	.414966	.4932757	0	1
secondary	441	.4013605	.4907304	0	1
tertiary	441	.154195	.3615457	0	1
exp	441	22.30612	11.36818	1	47
exp2	441	626.5057	527.8269	1	2209
female	441	.569161	.4957561	0	1
married	441	.7596372	.4277891	0	1
public	404	.4455446	.497642	0	1
union	441	.3786848	.4856103	0	1

country = NewZealand, year = 1995

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	230	6.677966	.6360815	4.625373	9.721166
preprimary	230	0	0	0	0
primary	230	.1173913	.322588	0	1
secondary	230	.5347826	.4998766	0	1
tertiary	230	.3478261	.4773193	0	1
exp	230	19.54783	10.94468	2	42
exp2	230	501.3826	459.3692	4	1764
female	230	.5086957	.5010147	0	1
married	230	.5826087	.4942041	0	1
public	226	.4513274	.49873	0	1
union	230	.3304348	.4713956	0	1

country = Bulgaria, year = 1992

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	415	4.07628	.5259286	2.157944	5.703783
preprimary	415	.0024096	.0490881	0	1
primary	415	.5108434	.5004858	0	1
secondary	415	.3518072	.4781106	0	1
tertiary	415	.1349398	.3420716	0	1
exp	415	23.21928	10.00278	4	47
exp2	415	638.9494	488.7758	16	2209
female	415	.5108434	.5004858	0	1
married	415	.853012	.3545213	0	1
public	412	.8980583	.3029396	0	1
union	415	.5036145	.5005904	0	1

country = Bulgaria, year = 1993

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	330	4.389815	.6447102	1.560053	7.536364
preprimary	330	.0242424	.1540345	0	1
primary	330	.5060606	.5007225	0	1
secondary	330	.3060606	.4615551	0	1
tertiary	330	.1636364	.3705071	0	1
exp	330	24.69091	9.94735	3	47
exp2	330	708.2909	500.2305	9	2209
female	330	.4909091	.5006765	0	1
married	330	.8424242	.364896	0	1
public	327	.8623853	.3450231	0	1
union	330	.5151515	.5005293	0	1

country = Russia, year = 1991

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	1635	1.928744	.6311619	-2.902794	4.564348
preprimary	1635	.0165138	.1274794	0	1
primary	1635	.2201835	.414497	0	1
secondary	1635	.204893	.4037469	0	1
tertiary	1635	.5584098	.4967285	0	1
exp	1635	20.17248	11.51034	0	54
exp2	1635	539.3358	536.3582	0	2916
female	1635	.493578	.5001117	0	1
married	1635	.7767584	.4165464	0	1
public	1603	1	0	1	1
union	1635	.8960245	.3053222	0	1

country = Russia, year = 1992

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	1038	3.41787	.714831	.7716495	6.214608
preprimary	1038	.0077071	.0874935	0	1
primary	1038	.3063584	.4612026	0	1
secondary	1038	.4643545	.4989682	0	1
tertiary	1038	.22158	.4155101	0	1
exp	1038	21.13102	10.45651	0	49
exp2	1038	555.7534	506.2289	0	2401
female	1038	.4980732	.5002373	0	1
married	1038	.7649326	.4242454	0	1
public	1026	.9610136	.1936568	0	1
union	1038	.9306358	.2541949	0	1

country = Russia, year = 1993

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	903	6.762507	.7629114	3.952845	9.315701
preprimary	903	.0033223	.0575751	0	1
primary	903	.3698782	.483039	0	1
secondary	903	.4916944	.5002081	0	1
tertiary	903	.1351052	.3420253	0	1
exp	903	22.74972	10.15487	1	49
exp2	903	620.557	500.5535	1	2401
female	903	.5581395	.4968835	0	1
married	903	.7497231	.4334125	0	1
public	896	.9866071	.1150141	0	1
union	903	.8084164	.3937652	0	1

country = Russia, year = 1994

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	837	8.496639	.9611553	5.596152	12.07571
preprimary	837	.004779	.069006	0	1
primary	837	.5770609	.4943213	0	1
secondary	837	.353644	.4783862	0	1
tertiary	837	.0645161	.245817	0	1
exp	837	22.73835	9.660982	2	48
exp2	837	610.2557	477.0265	4	2304
female	837	.6248507	.4844509	0	1
married	837	.7670251	.4229791	0	1
public	836	.9796651	.1412277	0	1
union	837	.7371565	.4404413	0	1

country = Russia, year = 1995

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	619	9.502589	.9764184	3.665163	12.42922
preprimary	619	.0145396	.1197972	0	1
primary	619	.3861066	.4872493	0	1
secondary	619	.4458805	.4974644	0	1
tertiary	619	.1534733	.3607347	0	1
exp	619	23.01454	10.59026	2	50
exp2	619	641.6414	523.2364	4	2500
female	619	.4959612	.500388	0	1
married	619	.6849758	.4649012	0	1
public	619	.8546042	.3527845	0	1
union	619	.644588	.4790251	0	1

country = Canada, year = 1995

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	585	6.858716	.5960844	4.135167	9.392662
preprimary	585	.0119658	.108825	0	1
primary	585	.0632479	.2436165	0	1
secondary	585	.3487179	.4769724	0	1
tertiary	585	.5760684	.4946026	0	1
exp	585	18.1265	10.23597	0	43
exp2	585	433.1658	406.6558	0	1849
female	585	.5384615	.4989451	0	1
married	585	.6034188	.4896063	0	1
public	569	.5571178	.4971639	0	1
union	585	.3880342	.4877195	0	1

country = Czechoslovakia, year = 1992

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	570	4.344427	.4799583	2.256396	6.418909
preprimary	570	.0052632	.07242	0	1
primary	570	.2859649	.4522697	0	1
secondary	570	.5385965	.4989459	0	1
tertiary	570	.1701754	.3761169	0	1
exp	570	21.89649	10.54898	1	44
exp2	570	590.5421	486.0187	1	1936
female	570	.477193	.4999183	0	1
married	570	.7824561	.4129379	0	1
public	563	.8081705	.3940898	0	1
union	570	.6298246	.4832756	0	1

country = Philippines, year = 1992

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	282	3.964411	1.242445	.2433461	7.929407
preprimary	282	.141844	.3495103	0	1
primary	282	.4113475	.4929528	0	1
secondary	282	.3794326	.4861085	0	1
tertiary	282	.0673759	.2511175	0	1
exp	282	21.3617	10.43453	4	53
exp2	282	564.8156	525.7584	16	2809
female	282	.3014184	.4596898	0	1
married	282	.8262411	.3795756	0	1
public	280	.25	.433788	0	1
union	282	.0567376	.2317518	0	1

country = Israel, year = 1993

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	452	4.138443	.7018897	2.140466	6.39693
preprimary	452	.0088496	.0937587	0	1
primary	452	.1725664	.3782907	0	1
secondary	452	.5641593	.4964159	0	1
tertiary	452	.2544248	.43602	0	1
exp	452	19.74779	9.805565	2	45
exp2	452	485.9115	425.1569	4	2025
female	452	.550885	.4979551	0	1
married	452	.7853982	.4110007	0	1
public	433	.551963	.4978677	0	1
union	452	.4115044	.4926515	0	1

country = Israel, year = 1994

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	566	4.340412	.6605076	2.684334	6.879584
preprimary	566	.0053004	.0726746	0	1
primary	566	.2137809	.4103366	0	1
secondary	566	.5812721	.493787	0	1
tertiary	566	.1996466	.4000883	0	1
exp	566	21.11837	10.50083	3	54
exp2	566	556.0583	493.5524	9	2916
female	566	.540636	.4987868	0	1
married	566	.8339223	.3724796	0	1
public	554	.5234657	.4999004	0	1
union	566	.3498233	.4773359	0	1

country = Japan, year = 1993

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	471	4.213341	.7445137	2.288682	7.941829
preprimary	471	0	0	0	0
primary	471	.163482	.370198	0	1
secondary	471	.6581741	.4748259	0	1
tertiary	471	.1783439	.383209	0	1
exp	471	24.25902	11.36141	3	49
exp2	471	717.3079	561.1462	9	2401
female	471	.4309979	.4957424	0	1
married	471	.7643312	.4248673	0	1
public	471	.1210191	.3264963	0	1
union	471	.3460722	.4762224	0	1

country = Japan, year = 1994

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	484	4.234144	.6937169	2.322788	7.320601
preprimary	484	.0020661	.0454545	0	1
primary	484	.1652893	.3718257	0	1
secondary	484	.6466942	.4784912	0	1
tertiary	484	.1859504	.3894692	0	1
exp	484	23.7686	11.34934	2	48
exp2	484	693.4876	562.0629	4	2304
female	484	.4586777	.4988051	0	1
married	484	.7396694	.439269	0	1
public	484	.1239669	.3298848	0	1
union	484	.2975207	.4576405	0	1

country = Japan, year = 1995

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	427	4.264088	.7079626	1.373872	6.289299
preprimary	427	0	0	0	0
primary	427	.1288056	.3353776	0	1
secondary	427	.6393443	.480754	0	1
tertiary	427	.2318501	.4225088	0	1
exp	427	22.76815	11.45762	3	46
exp2	427	649.3583	541.9135	9	2116
female	427	.4379391	.4967155	0	1
married	427	.7330211	.4429002	0	1
public	427	.1498829	.3573753	0	1
union	427	.3302108	.4708405	0	1

country = Spain, year = 1993

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	226	8.097572	.5869009	5.829346	10.70199
preprimary	226	.0840708	.2781099	0	1
primary	226	.460177	.499518	0	1
secondary	226	.2433628	.4300648	0	1
tertiary	226	.2123894	.4099068	0	1
exp	226	22.68584	12.65485	0	54
exp2	226	674.0841	648.6841	0	2916
female	226	.340708	.4749994	0	1
married	226	.6327434	.4831273	0	1
public	221	.3167421	.466262	0	1
union	226	.2035398	.4035243	0	1

country = Spain, year = 1995

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	187	8.187683	.7211216	6.307546	10.81978
preprimary	187	.0481283	.214612	0	1
primary	187	.4652406	.5001294	0	1
secondary	187	.3048128	.4615639	0	1
tertiary	187	.1818182	.38673	0	1
exp	187	20.75936	11.9484	0	52
exp2	187	572.9519	569.1817	0	2704
female	187	.3262032	.4700812	0	1
married	187	.6417112	.4807848	0	1
public	183	.284153	.4522474	0	1
union	187	.2406417	.4286207	0	1

country = Latvia, year = 1995

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	328	.4556425	.7108162	-1.950364	2.302585
preprimary	328	.0030488	.0552158	0	1
primary	328	.3597561	.4806621	0	1
secondary	328	.4237805	.4949115	0	1
tertiary	328	.2134146	.410344	0	1
exp	328	22.94817	10.33034	2	46
exp2	328	633.0091	500.8039	4	2116
female	328	.5731707	.4953728	0	1
married	328	.6554878	.475935	0	1
public	316	.7310127	.4441367	0	1
union	328	.3689024	.4832447	0	1

country = SlovakRep, year = 1995

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	652	4.746306	.4266447	3.2288	6.620073
preprimary	652	.0015337	.039163	0	1
primary	652	.2760736	.4473969	0	1
secondary	652	.5828221	.4934714	0	1
tertiary	652	.1395706	.346807	0	1
exp	652	20.06748	10.32104	2	46
exp2	652	509.0644	456.0898	4	2116
female	652	.4570552	.4985348	0	1
married	652	.696319	.4601996	0	1
public	650	.6307692	.4829682	0	1
union	652	.493865	.5003462	0	1

country = EGermany, year = 1990

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	533	3.254493	.3649641	1.824283	5.403678
preprimary	533	0	0	0	0
primary	533	.7335835	.4424999	0	1
secondary	533	.1332083	.3401189	0	1
tertiary	533	.1332083	.3401189	0	1
exp	533	23.62664	10.72194	3	47
exp2	533	672.9625	547.6666	9	2209
female	533	.4953096	.5004477	0	1
married	533	.7636023	.4252683	0	1
public	531	.3596987	.4803645	0	1
union	533	0	0	0	0

country = EGermany, year = 1991

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	715	3.267453	.3533356	1.714798	4.442651
preprimary	715	0	0	0	0
primary	715	.7622378	.4260108	0	1
secondary	715	.1314685	.3381486	0	1
tertiary	715	.1062937	.3084289	0	1
exp	715	24.61538	10.63286	4	47
exp2	715	718.8168	557.1162	16	2209
female	715	.4895105	.5002399	0	1
married	715	.7552448	.430243	0	1
public	670	.3477612	.4766156	0	1
union	715	.5272727	.4996051	0	1

country = EGermany, year = 1992

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	412	3.525883	.4235461	1.714798	5.113222
preprimary	412	0	0	0	0
primary	412	.8033981	.397912	0	1
secondary	412	.0849515	.2791484	0	1
tertiary	412	.1116505	.3153189	0	1
exp	412	23.81068	10.82882	2	47
exp2	412	683.9272	557.9664	4	2209
female	412	.5024272	.500602	0	1
married	412	.7330097	.4429251	0	1
public	392	.3571429	.4797698	0	1
union	412	.473301	.4998937	0	1

country = EGermany, year = 1993

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	332	3.752702	.4105451	2.654806	6.384507
preprimary	332	.003012	.0548821	0	1
primary	332	.7349398	.4420315	0	1
secondary	332	.1716867	.3776772	0	1
tertiary	332	.0903614	.2871316	0	1
exp	332	24.56024	9.876243	2	47
exp2	332	700.4518	504.4357	4	2209
female	332	.4548193	.4987061	0	1
married	332	.6506024	.4774994	0	1
public	331	.2990937	.4585541	0	1
union	332	.4518072	.4984232	0	1

country = EGermany, year = 1995

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	249	3.886833	.5730639	1.244795	6.543112
preprimary	249	0	0	0	0
primary	249	.62249	.4857404	0	1
secondary	249	.2248996	.4183571	0	1
tertiary	249	.1526104	.3603359	0	1
exp	249	25.35341	10.26835	5	44
exp2	249	747.8112	537.5899	25	1936
female	249	.4738956	.5003238	0	1
married	249	.7389558	.4400886	0	1
public	235	.3957447	.4900538	0	1
union	249	.8514056	.3564046	0	1

country = NIreland, year = 1989

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	257	5.489693	.552061	3.686105	7.20786
preprimary	257	0	0	0	0
primary	257	.5758755	.4951737	0	1
secondary	257	.4241245	.4951737	0	1
tertiary	257	0	0	0	0
exp	257	21.95331	11.1956	3	45
exp2	257	606.8016	555.8392	9	2025
female	257	.4552529	.4989654	0	1
married	257	.6964981	.4606672	0	1
public	247	.5465587	.4988384	0	1
union	257	.540856	.4993003	0	1

country = NIreland, year = 1990

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	257	5.584734	.5302141	4.025352	6.907755
preprimary	257	0	0	0	0
primary	257	.5330739	.4998784	0	1
secondary	257	.4669261	.4998784	0	1
tertiary	257	0	0	0	0
exp	257	21.38911	10.37483	3	44
exp2	257	564.7121	490.3926	9	1936
female	257	.4941634	.5009415	0	1
married	257	.7003891	.4589814	0	1
public	252	.5039683	.5009792	0	1
union	257	.5680934	.4963081	0	1

country = NIreland, year = 1991

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	273	5.655685	.5547309	4.230477	7.236259
preprimary	273	0	0	0	0
primary	273	.5311355	.4999461	0	1
secondary	273	.4688645	.4999461	0	1
tertiary	273	0	0	0	0
exp	273	21.47253	10.80408	3	45
exp2	273	577.37	505.23	9	2025
female	273	.5274725	.5001616	0	1
married	273	.7655678	.4244215	0	1
public	268	.4626866	.4995386	0	1
union	273	.7326007	.4434153	0	1

country = NIreland, year = 1993

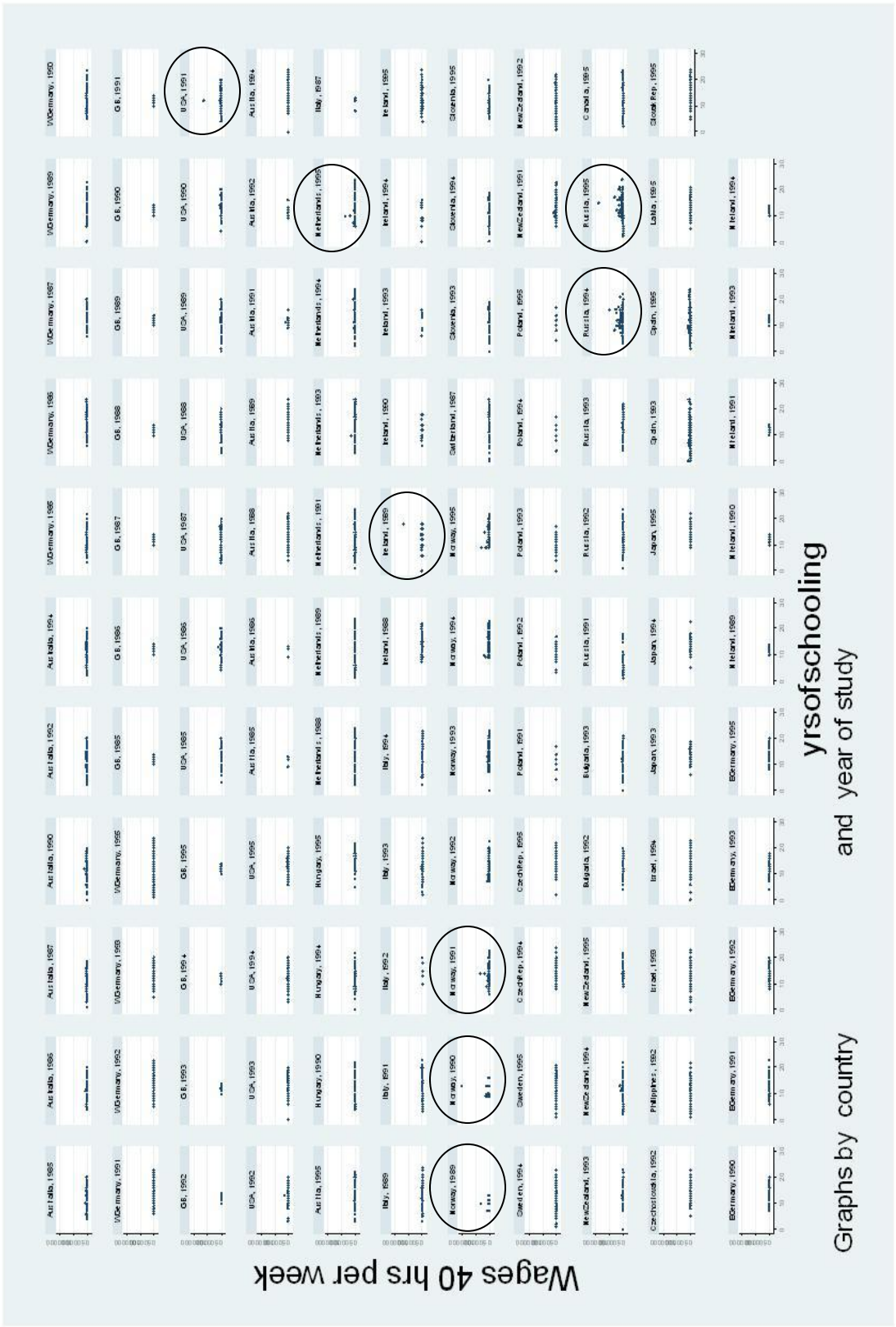
Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	253	6.022436	.5931839	4.584551	7.66396
preprimary	253	0	0	0	0
primary	253	.513834	.5007993	0	1
secondary	253	.486166	.5007993	0	1
tertiary	253	0	0	0	0
exp	253	22.35968	9.934761	5	45
exp2	253	598.2648	498.9657	25	2025
female	253	.5098814	.5008932	0	1
married	253	.7826087	.4132886	0	1
public	253	.4743083	.5003293	0	1
union	253	.5335968	.4998588	0	1

country = NIreland, year = 1994

Variable	Obs	Mean	Std. Dev.	Min	Max
lw40hrs	245	5.717382	.6459429	4.081922	7.57843
preprimary	245	0	0	0	0
primary	245	.522449	.5005183	0	1
secondary	245	.477551	.5005183	0	1
tertiary	245	0	0	0	0
exp	245	21.00816	10.35952	3	45
exp2	245	548.2245	487.3715	9	2025
female	245	.4571429	.4991797	0	1
married	245	.6938776	.4618247	0	1
public	0				
union	245	.477551	.5005183	0	1

APPENDIX 2

ADJUSTED DATA FOR WAGES PER WEEK UTILIZED IN THE PRELIMINARY STUDY SUGGESTING THE VIABILITY OF THE SHORT-CUT METHOD FOR ESTIMATING RETURNS TO INVESTMENTS IN EDUCATION SHOWING THE OUTLIERS FOUND IN THE OBSERVATIONS


Wages 40 hrs per week
yrsofschooling
Graphs by country
and year of study

APPENDIX 3

REGRESSION SPECIFICATIONS FOR THE 28 COUNTRIES USED IN THE ESTIMATION OF RETURNS TO EDUCATION THROUGH THE EARNINGS FUNCTION METHOD AS PART OF THE PRELIMINARY STUDY SUGGESTING THE VIABILITY OF THE SHORT-CUT METHOD FOR ESTIMATING RETURNS TO INVESTMENTS IN EDUCATION

	Australia	WGermany	GB	USA	Austria	Hungary	Netherlands	Italy
	lw40hrs	lw40hrs	lw40hrs	lw40hrs	lw40hrs	lw40hrs	lw40hrs	lw40hrs
primary	0.094	0.089	0.000	0.015	-0.238	0.128	0.036	0.061
	(0.93)	(0.79)	(.)	(0.04)	(0.91)	(0.61)	(0.36)	(0.91)
secondary	0.267	0.207	0.296	0.371	-0.043	0.464	0.178	0.300
	(2.58)**	(1.81)	(16.31)**	(1.05)	(0.17)	(2.21)*	(1.76)	(4.30)**
tertiary	0.419	0.438	0.000	0.767	0.185	0.833	0.349	0.717
	(3.84)**	(3.78)**	(.)	(2.15)*	(0.70)	(3.90)**	(3.42)**	(9.47)**
Exp	0.026	0.045	0.030	0.057	0.049	0.029	0.028	0.019
	(5.60)**	(14.00)**	(8.46)**	(5.37)**	(10.01)**	(4.51)**	(6.97)**	(3.27)**
exp2	-0.000	-0.001	-0.001	-0.001	-0.001	-0.001	-0.000	-0.00
	(4.11)**	(11.72)**	(7.29)**	(3.80)**	(8.46)**	(3.88)**	(4.23)**	(1.67)
female	0.180	0.022	0.036	-0.249	0.088	-0.162	0.574	0.058
	(7.97)**	(1.39)	(2.18)*	(4.25)**	(3.91)**	(5.58)**	(26.98)**	(2.08)*
married	0.143	0.129	0.123	0.113	0.080	-0.016	0.306	0.036
	(5.32)**	(7.68)**	(6.14)**	(1.90)	(3.22)**	(0.49)	(13.09)**	(1.05)
Public	0.130	0.081	0.121	0.063	0.039	-0.065	0.016	0.275
	(5.35)**	(4.88)**	(6.52)**	(0.90)	(1.58)	(0.84)	(0.67)	(9.31)**
union	0.025	0.028	0.026	0.195	-0.007	0.051	-0.015	-0.026
	(1.04)	(1.73)	(1.49)	(2.61)**	(0.29)	(1.43)	(0.69)	(0.91)
year	0.045	0.052	0.081	0.092	0.046	0.217	0.110	0.170
	(12.61)**	(19.75)**	(25.91)**	(1.54)	(10.16)**	(28.87)**	(27.58)**	(29.64)**
Constant	-83.372	-99.374	-157.101	-177.264	-87.007	-427.517	-212.766	-337.586
	(11.81)**	(19.09)**	(25.12)**	(1.50)	(9.56)**	(28.56)**	(26.84)**	(29.58)**
Obs.	4467	3997	4299	924	2261	1256	3318	1991
R-squared	0.11	0.22	0.23	0.15	0.17	0.54	0.38	0.42

Absolute value of t statistics in parentheses
* significant at 5%; ** significant at 1%

	Ireland	Norway	Switzerland	Slovenia	Sweden	CzechRep	Poland	NewZealand
	lw40hrs	lw40hrs	lw40hrs	lw40hrs	lw40hrs	lw40hrs	lw40hrs	lw40hrs
primary	0.850	0.051	0.208	0.035	0.110	0.278	-0.049	-0.083
	(2.52)*	(0.16)	(1.04)	(0.34)	(1.22)	(0.62)	(0.25)	(0.74)
secondary	1.123	0.114	0.611	0.438	0.230	0.349	0.290	0.009
	(3.31)**	(0.35)	(2.98)**	(4.13)**	(2.49)*	(0.78)	(1.47)	(0.08)
tertiary	1.675	0.159	0.750	0.844	0.277	0.500	0.778	0.081
	(4.92)**	(0.49)	(3.56)**	(7.36)**	(2.92)**	(1.11)	(3.90)**	(0.70)
Exp	0.044	0.034	0.044	0.015	0.026	0.005	0.014	0.020
	(7.35)**	(12.36)**	(4.07)**	(1.90)	(5.51)**	(0.83)	(2.55)*	(3.58)**
exp2	-0.001	-0.001	-0.001	-0.000	-0.000	-0.000	-0.000	-0.000
	(5.26)**	(9.58)**	(2.53)*	(1.01)	(3.89)**	(0.28)	(1.22)	(2.82)**
female	0.067	0.061	0.032	-0.102	0.019	-0.165	-0.093	0.176
	(2.16)*	(4.41)**	(0.54)	(3.50)**	(0.79)	(5.09)**	(4.13)**	(6.05)**
married	0.093	0.090	0.084	0.035	0.056	-0.102	0.058	0.118
	(2.59)**	(5.61)**	(1.41)	(0.91)	(2.13)*	(2.61)**	(2.15)*	(3.36)**
public	0.197	0.027	0.059	-0.030	-0.026	-0.022	-0.044	0.134
	(5.78)**	(1.76)	(1.03)	(0.66)	(1.05)	(0.62)	(1.70)	(4.16)**
union	0.169	0.058	0.044	-0.010	-0.014	0.023	0.080	-0.101
	(5.14)**	(3.80)**	(0.82)	(0.27)	(0.41)	(0.65)	(3.37)**	(3.16)**
year	0.036	0.013	0.000	0.106	-0.017	0.176	0.240	0.013
	(6.34)**	(3.75)**	(.)	(5.87)**	(0.73)	(5.50)**	(29.37)**	(1.17)
Constant	-68.970	-18.082	3.162	-204.631	38.323	-346.626	-473.741	-19.897
	(6.01)**	(2.61)**	(13.27)**	(5.69)**	(0.85)	(5.43)**	(29.15)**	(0.89)
Obs.	1924	4790	400	1119	1177	783	2761	1998
R-squared	0.26	0.09	0.26	0.24	0.09	0.10	0.36	0.06

Absolute value of t statistics in parentheses
* significant at 5%; ** significant at 1%

	Bulgaria	Russia	Canada	Czechoslov	Philippines	Israel	Japan	Spain
	lw40hrs	lw40hrs	lw40hrs	lw40hrs	lw40hrs	lw40hrs	lw40hrs	lw40hrs
primary	-0.533	0.055	0.004	-0.611	0.227	-0.246	0.117	0.161
	(2.79)**	(0.40)	(0.02)	(2.25)*	(1.02)	(0.99)	(0.19)	(1.05)
secondary	-0.364	0.134	0.136	-0.548	1.254	-0.119	0.609	0.390
	(1.88)	(0.96)	(0.64)	(2.03)*	(4.98)**	(0.48)	(0.99)	(2.32)*
tertiary	-0.125	0.325	0.348	-0.381	2.212	0.247	0.895	0.781
	(0.63)	(2.30)*	(1.64)	(1.39)	(6.35)**	(0.97)	(1.45)	(4.44)**
exp	0.002	0.014	0.001	0.019	0.028	-0.000	0.044	0.022
	(0.25)	(2.88)**	(0.10)	(2.22)*	(1.03)	(0.05)	(5.95)**	(1.98)*
exp2	-0.000	-0.000	0.000	-0.000	-0.001	0.000	-0.000	-0.000
	(0.32)	(3.23)**	(0.94)	(2.04)*	(0.95)	(0.75)	(3.16)**	(1.25)
female	-0.125	-0.086	-0.031	-0.152	-0.084	0.297	-0.330	0.096
	(3.03)**	(3.26)**	(0.66)	(3.83)**	(0.57)	(7.29)**	(9.41)**	(1.43)
married	0.104	0.064	-0.013	-0.012	-0.059	0.046	0.036	0.015
	(1.76)	(2.07)*	(0.27)	(0.24)	(0.33)	(0.84)	(0.76)	(0.22)
public	-0.111	0.283	0.251	-0.050	-0.549	0.102	0.229	0.036
	(1.64)	(3.73)**	(4.77)**	(0.91)	(3.12)**	(2.35)*	(4.53)**	(0.50)
union	0.078	-0.069	0.075	0.131	0.512	0.083	0.162	0.035
	(1.77)	(1.91)	(1.44)	(2.93)**	(1.79)	(1.80)	(4.42)**	(0.45)
year	0.299	2.098	0.000	0.000	0.000	0.246	0.026	0.056
	(7.18)**	(200.95)**	(.)	(.)	(.)	(6.07)**	(1.28)	(1.82)
Constant	-591.741	-4,175.633	6.370	4.730	3.101	-486.540	-49.361	-105.135
	(7.12)**	(200.62)**	(27.84)**	(16.47)**	(7.97)**	(6.02)**	(1.21)	(1.70)
Obs.	739	4980	569	563	280	987	1382	404
R-squared	0.15	0.91	0.13	0.09	0.24	0.17	0.28	0.13

Absolute value of t statistics in parentheses
* significant at 5%; ** significant at 1%

	Latvia	SlovakRep	EGermany	NIreland
	lw40hrs	lw40hrs	lw40hrs	lw40hrs
primary	0.965	-0.902	-0.191	0.000
	(1.37)	(2.22)*	(6.85)**	(.)
secondary	1.141	-0.774	-0.095	0.329
	(1.61)	(1.91)	(2.75)**	(9.69)**
tertiary	1.384	-0.477	0.000	0.000
	(1.95)	(1.17)	(.)	(.)
exp	-0.002	0.009	0.018	0.051
	(0.11)	(1.23)	(4.45)**	(7.05)**
exp2	0.000	-0.000	-0.000	-0.001
	(0.07)	(0.89)	(4.46)**	(5.49)**
female	-0.093	-0.118	-0.042	0.064
	(1.12)	(3.69)**	(2.31)*	(2.00)*
married	0.070	0.036	0.034	0.030
	(0.81)	(0.94)	(1.66)	(0.79)
public	-0.062	-0.074	0.092	0.184
	(0.63)	(2.09)*	(4.83)**	(5.31)**
union	0.182	0.093	-0.041	0.026
	(2.10)*	(2.73)**	(2.07)*	(0.75)
year	0.000	0.000	0.150	0.125
	(.)	(.)	(23.94)**	(11.63)**
Constant	-0.668	5.439	-296.133	-244.687
	(0.93)	(13.20)**	(23.67)**	(11.41)**
Obs.	316	650	2159	1020
R-squared	0.08	0.12	0.27	0.30

Absolute value of t statistics in parentheses
* significant at 5%; ** significant at 1%

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